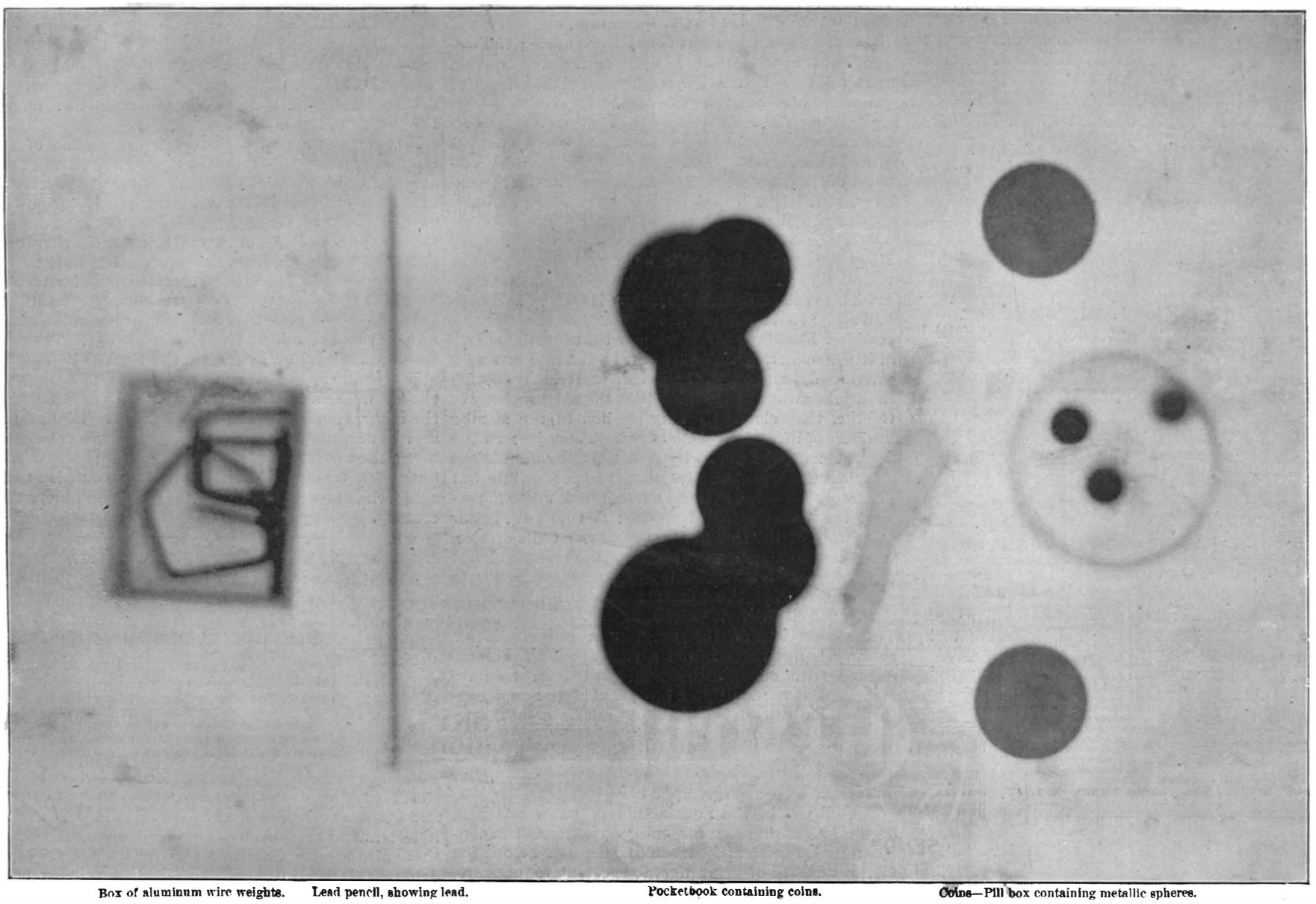
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class matter.] Copyright, 1896, by Munn & Co.

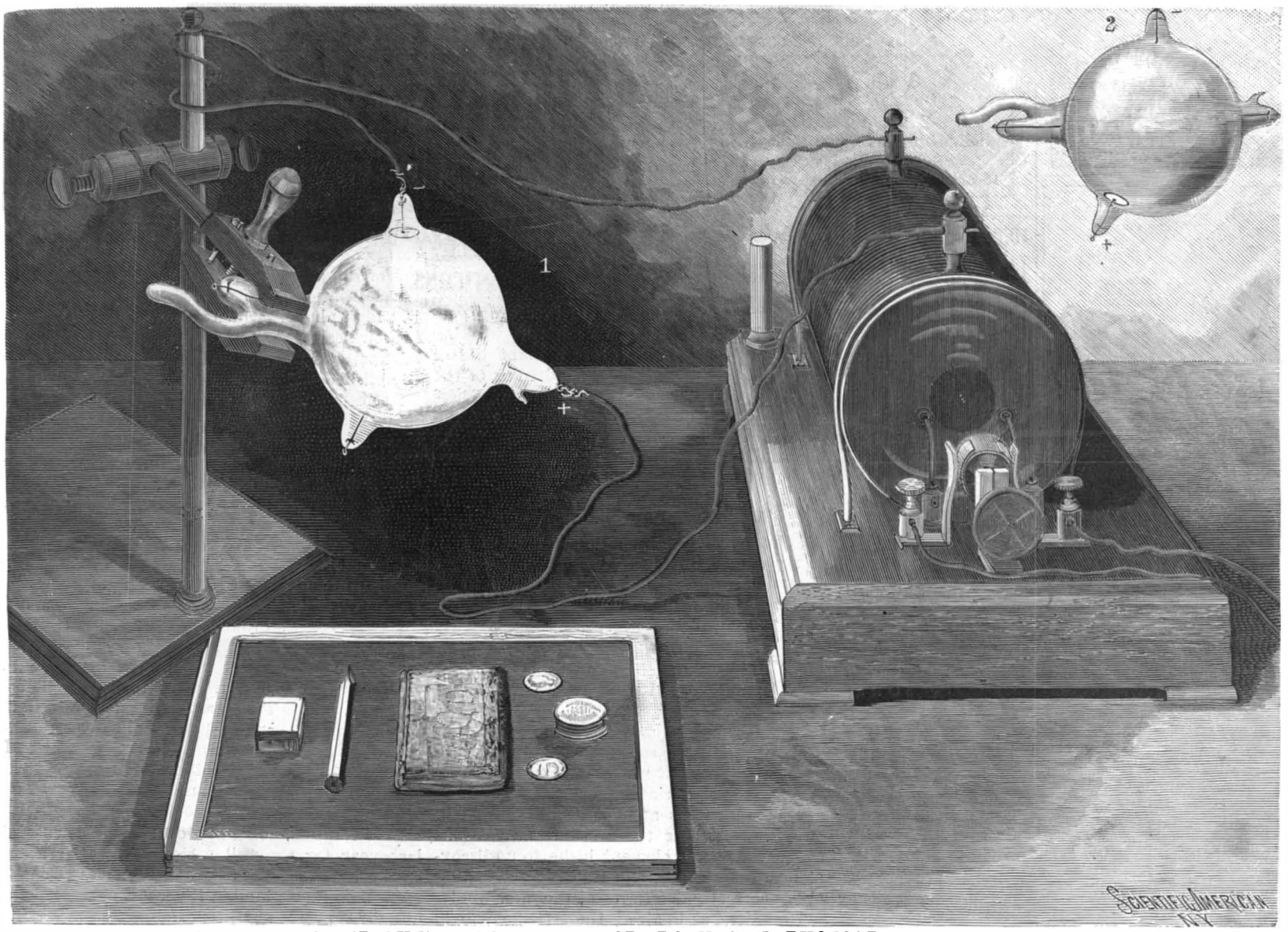
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXXIV.—No. 7. [ESTABLISHED 1845.] NEW YORK, FEBRUARY 15, 1896 [$3.00 A YEAR. WEEKLY.



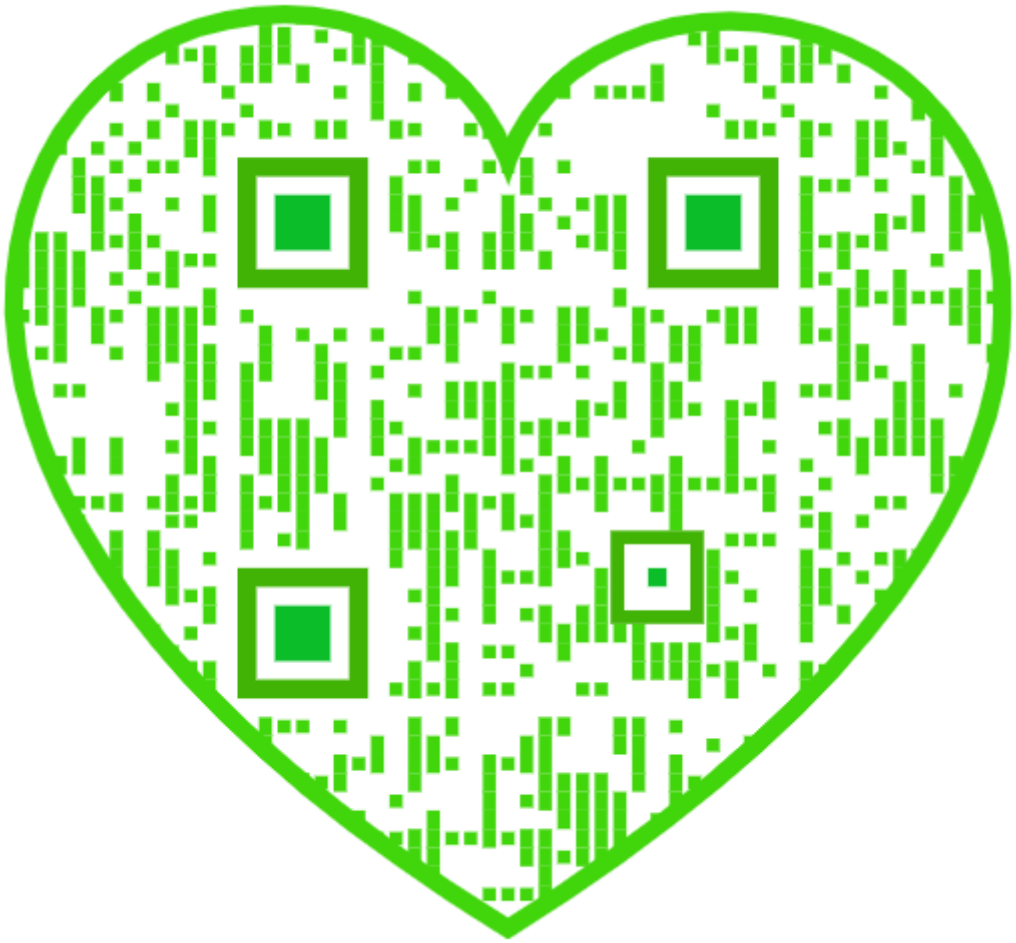
Box of aluminum wire weights. Lead pencil, showing lead. Pocketbook containing coins. Coins—Pill box containing metallic spheres.

RAY PHOTOGRAPHS TAKEN BY PROF. A. W. WRIGHT AT YALE UNIVERSITY.



PROF. A. W. WRIGHT'S APPARATUS FOR ROENTGEN PHOTOGRAPHY.—[See page 103.]

© 1896 SCIENTIFIC AMERICAN, INC.



Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

TERMS FOR THE SCIENTIFIC AMERICAN.
(Established 1845.)

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union 4 00
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement
(Established 1876.)

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union *eight dollars and fifty cents a year.*

Building Edition of Scientific American.
(Established 1885.)

THE BUILDING EDITION OF THE SCIENTIFIC AMERICAN is a large and splendidly illustrated periodical, issued monthly, containing floor plans and perspective views pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico. $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, $5.00 a year. To foreign Postal Union countries, $6.50 a year. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign Postal Union countries, $11.00 a year.

Export Edition of the Scientific American,
(Established 1878.)

with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 50 pages, profusely illustrated. It is the finest scientific, industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places throughout the world. $3.00 a year, post paid to any part of the world. Single copies, 25 cents.

☞ Manufacturers and others who desire to secure foreign trade, may have large and handsomely displayed announcements published in this edition at a very moderate cost. MUNN & CO., Publishers,
361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure, delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, FEBRUARY 15, 1896.

Contents.

(Illustrated articles are marked with an asterisk.)

Acetylene for steam engines.... 102
Acetylene gas (6724)..... 109
Algol variable, Wells'..... 99
Aluminum..... 104
Antelope, the konzi*..... 107
Batteries, storage (6719)..... 109
Bit, the Ford*..... 102
Blowpipe, Walmsley's*..... 100
Books and publications, new..... 108
Calorimeter, improved..... 102
Cart, scraping, Hawkins'*..... 109
Celluloid collar exploded..... 106
Clocks, Japanese*..... 101
Crookes, William, F.R.S.*..... 107
Dustpan, housemaid and the... 103
Electric carriage, Morris & Salom's*..... 105
Electric motor wagon, Sturges'*. 105
Employers' liability..... 100
Exposition, Brazil..... 106
Filter, a water system, Ricks'*... 101
Frost, windows, preventing..... 99
Fuse design, prize for..... 106
Gasoline carriage, Hertel's*..... 105
Gelatine casts, making (6722)..... 109
Guns, big, Indiana's, firing..... 99
Helena, gunboat, launching..... 99
Honors, French, for scientists... 99
Horse detacher, Friedlander's*. 100
Horseflesh in Paris..... 98
Incrustation, gas engine..... 99
Inventions, household..... 99
Lead burning..... 100
Lightning conductors, blast furnace..... 106
Liquid, new heavy..... 103
Locomotive spark arrester, Solomon's*..... 100
Monstrosities, artificial..... 106
Motor and lathe, direct connected*..... 104
Motor carriages, American*..... 105
Patents granted, weekly record. 109
Pathway, spiral, in Paris*..... 104
Photography, Roentgen or X ray*..... 103
Printers' rollers (6718)..... 108
Public Art League..... 98
Science, new works of..... 98
Stations, gas engine, for trunk railways..... 104
Steam carriage, Ames'*..... 105
Sun dials, Japanese*..... 101
Timber supports..... 106
Wire straightener (6721)*..... 109
Wool, mineral, danger in..... 99

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT No. 1050.

For the Week Ending February 15, 1896.

Price 10 cents. For sale by all newsdealers

PAGE

I. ARCHITECTURE.—Classic Architecture from the Point of View of an Architect.—A discourse before Johns Hopkins University at Baltimore, Md.—Continuation of this most valuable article, giving a very full resume of the architecture of Rome and of Greece in classic days..... 16776

II. BOTANY.—Guttapercha from Leaves.—An interesting source of guttapercha, which may have important effects..... 16790
Original Form of Wild Maize.—By J. P. ROTHWELL.—Reversion or degradation of cultivated maize as observed in Africa..... 16789
The Peanut Plant.—The nature and method of cultivation and harvesting of the popular edible..... 16790

III. ELECTRICITY.—Electrical notes in all branches of the science, from various sources..... 16784
Magnetic Tester for Sheet Iron.—Apparatus for testing the magnetic qualities of sheet iron, destined for use in electro-magnetic apparatus..... 16783
The Arc Light.—Lecture II continued.—By Prof. SILVANUS P. THOMPSON.—2 illustrations..... 16780
The Singing Electric Bell.—An electric bell producing a singing note instead of the ordinary disagreeable ring.—1 illustration..... 16782

IV. ELECTRICAL ENGINEERING.—The Electrolytic Action of Return Currents in Electrical Tramways.—By JOHN GRAY, B.Sc., in the Electrical Review.—An elaborate paper on the injury done by the return circuits of trolley lines.—The causes and suggested remedies..... 16782

V. ENGINEERING NOTES.—Notes on general engineering topics from various sources..... 16784

VI. HORTICULTURE.—Cypripedium with Petaloid Sepals.—A beautiful flower of peculiar structure.—1 illustration..... 16790

VII. MECHANICAL ENGINEERING.—New Triple Expansion Pumping Engines.—New triple expansion engines for the Leicester, England, waterworks.—1 illustration..... 16783

VIII. MINING ENGINEERING.—Electronite.—A new explosive tested for its safety from liability of causing explosions..... 16779

IX. MISCELLANEOUS.—The Electric Dancing Puppets.—An interesting toy of easy construction.—1 illustration..... 16782

X. NAVAL ENGINEERING.—Canet Electric Turrets.—Short description of the most recent French turrets for men-of-war.—2 illustrations..... 16775

XI. ORDNANCE.—Penetration of the Lee-Metford Rifle.—Experiments with the new English rifle.—Details of its astonishing power of penetration..... 16779

XII. PHOTOGRAPHY.—Retouching and Spotting Negatives.—By E. J. WALL, F.R.P.S.—A practical paper on this work of special importance to an amateur photographer..... 16777
The Metol and Amidol Developer.—By F. C. BEACH.—A practical paper on a new mixed developer, giving the formula for making it, and its qualities..... 16777

XIII. PHYSICS.—"On a New Kind of Rays."—By W. C. ROENTGEN.—Prof. Roentgen's original paper giving details of his investigation.—The most important document in the case yet published giving definitely the scope of the new X ray photography and the properties of the rays producing it..... 16785
Prof. Roentgen's Discovery.—A. A. C. SWINTON, in Nature.—Results obtained with the new photography.—Investigations by an English experimenter.—A very important contribution to the literature of X ray photography.—1 illustration..... 16786

XIV. SCIENCE.—Miscellaneous Notes.—Notes on the various provinces of science from all sources..... 16784
The Science of Social Statistics.—Population.—A lecture by the Hon. Carroll D. Wright, United States Commissioner of Labor, giving valuable statistics of advanced theories..... 16785

XV. TECHNOLOGY.—The Gobelins Tapestry Manufacture.—By ROBERT GRIMSHAW.—A valuable and popular paper on the famous tapestry by one who has recently visited the factory.—2 illustrations..... 16778

XVI. TRAVEL AND EXPLORATION.—Abraham's Oak.—A celebrated tree in the Holy Land.—History and the traditions affecting it.—1 illustration..... 16787
Bronze Medals for the Challenger Expedition.—Illustrations of medals for those who participated in the great Challenger expedition, 1872 to 1876.—2 illustrations..... 16787
On Mountaineers and Mountaineering.—By EDWARD WHYMPER, in Leisure Hour.—A most graphic article on the ascent of mountains, with full details of Swiss mountaineering.—4 illustrations..... 16787

THE NEW WORKS OF SCIENCE.

As the proud nineteenth century draws to a close it would seem that its representatives have good reason to be proud of the legacy to be left by them to succeeding ages. The last century saw the infancy of the steam engine, saw the isolation of oxygen gas and of a few other substances in the field of chemistry, and that is nearly all in science given to the present age by its predecessor. Before 1800 the cities of the world were still lighted by lamps and candles; electricity had its highest development in the inefficient frictional electric machines; railroads and steamboats were not yet a factor in transportation, and even the roads of England had but begun to be made; the adage that there is nothing new under the sun applied with full force to the few achievements in science of the world one hundred years ago.

Then the nineteenth century commenced. Gas lighting was introduced and the nocturnal crimes of great cities almost ceased. Lavoisier's and Priestley's discovery of oxygen began to bear fruit, and modern chemistry, which is a little over a century old, gradually took a position in the world of science. The galvanic battery gave strong current electricity, Sir Humphry Davy produced the electric light and the metals of the alkalies; the steamboat, locomotive and telegraph came into existence, and for a time it seemed as if man had all he could attend to in developing the new discoveries. Faraday's investigations led to the invention of the magneto generator; slowly the idea of a self-exciting dynamo was developed, and slowly enough the world awoke to the idea that the old prophecy of Goethe, that electricity only applied to the smaller business of life, might be falsified. Then, just as the use of currents of electricity of engineering dimensions was being developed, the almost imperceptible but delicately governed induced current was made to produce the transmission of speech; so that now, in our utilization of the thousand horse power units of electricity for engineering work, and of the minute, almost absolute units for telephonic work, we seem equally to avail ourselves of the colossal and of the microscopic powers, of electricity.

The assertion of the progress in science of this century is not needed, and a year ago it would have seemed trite enough to have exalted its achievements. But now, within a few years of the new century, and all within the space of a few months, developments and discoveries, few in number, but of importance enough and wonderful enough to fairly overthrow all our ideas of the limitations of man's power, have been thrust upon us.

The subject of the liquefaction of gases has long been a fascinating one for the physicist and experimenter. Chlorine and carbon dioxide were among the first, a number of years ago, to succumb to pressure, and after awhile scientists established two classes of gases, the fixed and the liquefiable gases. This division no longer exists. All the elemental gases have been liquefied, and the apparatus has been so perfected that with comparatively simple appliances, and in a space of ten minutes, liquid air can be collected like water in an open vessel, and the assertion has been made within a few months, by one of the best qualified investigators of the world, that in the near future liquid air will probably be the great source of artificial cold. Even more wonderful is the liquefaction of air produced by the cold due to its own expansion, which has been accomplished recently on what may be termed the commercial scale. We may within a few years see liquid air supplied and used by the liter like any common chemical.

The old time gas engineer produced hydrocarbon gases from hydrocarbons prepared in preceding geologic ages by the mighty forces of nature working through the quiet agency of the profuse plant life of the carboniferous and other eras. The dreams of the advanced technologist, who recognized the crudeness of the coal gas and water gas processes, the latter seeming but slightly an advance over its predecessor, would sometimes take the shape of the future synthesis or direct combination of carbon and hydrogen. If this could be done on the large scale, gas making would stand upon a new and scientific footing. The later triumphs of chemistry are largely in this field of synthesis, and now, in the direct production on the large scale of a hydrocarbon, chemistry has distanced its greatest achievements of the past as far as the technical field is concerned. Acetylene will always remain one of the milestones of the world's progress. Its production is due to the development of the dynamo—it is a gift made by physics to its sister science, chemistry.

The analysis of air was early attempted, and has been made so often that it seemed as if its composition was settled forever. It was always treated as of fixed composition, no variation being found in it wherever collected, unless artificially contaminated. But within a few months the world of science was startled to hear that an element hitherto undiscovere was a constituent of air, and that its composition had never been correctly determined; the new analysis showed the existence in air of the strange neutral element, argon. Argon and acetylene represent triumphs of the opposite branches of chemistry—of analysis and of synthesis respectively.

And now the world is electrified over a new discovery exemplified by the reproduction of an image of an object through opaque screens by hitherto unknown rays—we allude to Roentgen's discovery of X ray photography. Science had accepted the undulatory theory of light; it had, by referring light phenomena to wave motion of the luminiferous ether, accounted for all the actions of light, a mathematical explanation of refraction and reflection had been reached, and the undulatory theory of light seemed to include actinism or photography. Since the beginning of the present year the epoch making work of Roentgen has been published, and it presents no greater degree of achievement than it does of mystification as it affects the theory of light.

No age has ever witnessed such a succession of triumphs of science in so short a time. The effect of the cumulated wonders is to prepare us for any revelation of science—to almost dangerously increase our powers of belief. They make it harder than ever to discern and fix the true limits of natural science. To the working scientist, the discoveries are an inspiration, for they show him that the extreme elevation of universal knowledge has not yet been reached; he still has heights of discovery to climb, of altitude unimagined seriously by the world of but a decade ago. The synthesis of carbon and hydrogen, the liquefaction of air and hydrogen, the discovery of argon, and the discovery of X ray photography, will add new luster to the names connected with the work. Rayleigh, Ramsay, Dewar, and Roentgen among the pure scientists, and Wilson and Linde among the technologists, will have their fame increased by the renown which their achievements will impart to the expiring nineteenth century.

THE PUBLIC ART LEAGUE OF THE UNITED STATES.

We are in receipt of a copy of the constitution of this league, which has been formed "to promote the passage of a law, or laws, by Congress, requiring that before purchase or adoption by the government of any work of art (sculpture, painting, architecture, landscape design, coin, seal, medal, note, stamp, or bond), the design or model for the same shall be submitted to a commission of experts for an expression of opinion as to its artistic merit; and that the approval of such committee shall be a prerequisite to its adoption."

Richard Watson Gilder, editor of the Century Magazine, New York, is the president, and the list of officers and directors contains some of the most famous names in letters and art in America. We notice among others those of Augustus St. Gaudens, W. M. Chase, Joseph Jefferson, D. H. Burnham, Mrs. M. S. Van Rensselaer, and Charles Dudley Warner.

The object of this league is a distinctly patriotic one, and it should commend itself to all those who have the artistic reputation of their country at heart. The public buildings which are erected by the government of a country, the statues which grace its parks, the parks themselves, the various works of art that fill its museums, and the very designs which are impressed upon all government seals and official documents, are taken by the world at large as representing the best artistic possibilities of the nation.

As a matter of fact, however, it cannot be said that in every case our public works, of the kind enumerated above, do justly express the artistic sense of the American people. Although we have many monuments of art of which any nation might be proud, it is undeniable that others are in existence, and some of them in "high places," which would never have been erected if their design had been first submitted to such a board of experts as the Public Art League is seeking to have established.

According to Article IV of the constitution, persons may become members of the league by authorizing the secretary to sign their names to the constitution. Names should be sent to Mr. Glenn Brown, acting secretary, National Union Building, Washington, D. C.

The Use of Horseflesh in Paris.

The statistical bulletin of the French Ministry of Agriculture, dealing with the consumption of horseflesh in Paris last year, gives the number of horses killed for consumption as food at 23,186, this being exclusive of 43 mules and 383 donkeys. The total weight of meat sold was 5,130 tons, and this was sold at 186 shops or stalls, which are not allowed to sell any other kind of meat. The maximum price ranged from 18 cents a pound for the fillet to 4 cents a pound for the necks and lower ribs. The report adds that not more than a third of the meat is sold at the stalls, the remainder going to make sausages.

THE total salmon pack of the Pacific coast during last year, for the full spring and fall seasons, was 2,034,877 cases. Of this amount 627,000 cases were packed on the Columbia River, 637.000 cases in Alaska, and 512,877 cases in British Columbia.

© 1896 SCIENTIFIC AMERICAN, INC.

Wells' Algol Variable.

We have received the following report from Prof. William H. Pickering of the astronomical observatory of Harvard College. The report reads as follows:

A minimum of the Algol star, B. D. + 17° 4367, occurred as predicted on the afternoon of January 5, 1896. Through the courtesy of Professor Young, observations were obtained at Princeton by Professor Taylor Reed, with the 23 inch equatorial. It was also observed by Mr. W. M. Reed at Andover. Preparations had been made at this observatory to obtain a series of photographic images of it automatically, each having an exposure of 5 minutes, to observe it photometrically with the 15 inch equatorial, and also visually with the 12 and 6 inch equatorials. Unfortunately, owing to clouds, few observations were obtained, but these serve to show that the star was faint and diminishing in brightness as expected. Similar preparations were made for the next minimum, January 10, but again clouds prevented observation.

The observations so far obtained show that its time of minimum, uncorrected for the velocity of light, can be closely represented by the formula J. D. 2412002·500 + 4·8064 E. For nearly two hours before and after the minimum it is fainter than the twelfth magnitude. It is impossible, at present, to say how much fainter it becomes or whether it disappears entirely. It increases at first very rapidly and then more slowly, attaining its full brightness, magnitude 9·5, about five hours after the minimum. One hundred and thirty photographs indicate that, during the four days between the successive minima, it does not vary more than a few hundredths of a magnitude. The variation may be explained by assuming that the star revolves around a comparatively dark body and is totally eclipsed by it for two or three hours, the light at minimum, if any, being entirely that of the dark body. The conditions resemble those of U Cephei, which appears to be totally eclipsed by a relatively dark body two and a half magnitudes fainter than itself, but having a diameter at least one-half greater. The variation in light of B. D. + 17° 4367 is more rapid than that of any other star hitherto discovered, and as its range is greater than that of any known star of the Algol type, its form of light curve can be determined with corresponding accuracy. U Cephei is second in both these respects.

THE NEW STAR IN CENTAURUS.

The Nova follows the nebula N. G. C. 5253, and 1s north of it. The nebula is assumed to be C. DM. —31° 10536, magn. 9·5, with which it was originally identified. As seen with a low power the nebula cannot be readily distinguished from a star. Its magnitude on the Cordoba scale by comparison with adjacent stars was estimated by Mr. Wendell as 9·7, and it could hardly have been overlooked in preparing the Cordoba Durchmusterung, in which many adjacent fainter stars are given. The new star could not have been observed at Cordoba unless we assume, first, that it was bright at that time, although invariably too faint to be photographed on fifty nights distributed over six years; and secondly, that the nebula was overlooked at Cordoba while observing fainter objects in the same region. Even if we make these assumptions, the new star still falls in the same class as T Coronae, which was observed in the northern Durchmusterung several years preceding its appearance as a new star.

The positions of the Nova derived from these plates differ from each other by only 0s. ·1 in right ascension and 1″ in declination. The mean position for 1875 is R.A. = 13h. 32m. 51s. ·8, Dec. = —30° 59′ 58″. It will be noticed that according to these measures, the Nova follows N. G. C. 5253 by 1s. ·7, and is 24″ north.

Danger in Mineral Wool.

Another report of the Boston Manufacturers' Mutual Insurance Company calls attention, incidentally, to the danger attending the careless use of mineral wool in certain cases. Every one knows that this substance is made by blowing steam or air through melted iron slag. The slag is a sort of impure glass, and the "wool" is, therefore, a mass of fine threads of glass, interspersed, usually, with globules. The threads, though very slender, being finer than cotton fibers, are of glass, and, as the report points out, pieces of them may, unless the material is carefully handled, get under the nails, or into the skin, causing painful irritation; and when the dust from it is incautiously breathed, it has been known to produce hemorrhage. A similar material is "rock wool," which is said to be made of melted glass, and the fibers of which are even sharper and harder, and, therefore, more capable of inflicting injury than those of the slag wool. It may be noticed that the men who apply the mineral wool, which, it is needless to say, is very extensively used in building, for packing pipes, filling in partitions and floors, and so on, do not handle it much, using sticks to compact it in place, and the American Architect suggests that those who have occasion to use it as amateurs will do well to imitate this precaution.

French Honors for Scientists, Artists, and Men of Letters.

On the occasion of the centenary of the French Institute, Prof. Max Müller, who is an Associate of the Academy of Letters, was appointed commander of the Legion of Honor. Prof. Ramsay and Lord Rayleigh, as well as Messrs. Simon Newcombe, Alexander Agassiz, and Rowland, of the United States, who are all corresponding members of the Academy of Science, were made officers of the Legion of Honor; while Mr. Adolphus Hall, of America, a corresponding member of the Academy of Science, was appointed chevalier of the Legion of Honor. In the new year's batch of promotions in the Legion of Honor three American painters, MacEwen, MacMonnies, and Melchers, are made chevaliers; MM. De Morgan, the director-general of antiquities in Egypt, Dieulafoy, the explorer of Babylon, and Leroy-Beaulieu, the political economist, are made officers; Francis Charmes, the essayist, Jules Claretie, director of the Comedie Francaise, Lavisse, the historian, Maspero, the Egyptologist, Victor Massenet, Gaston Paris, the romance philologist, and Sully-Prudhomme, the poet, are made commanders; and MM. Joseph Bertrand, the mathematician, Gaston Boissier and Ernest Legouvé, of the Academie Francaise, Leopold Delisle, librarian of the National Library, and Garnier, architect of the Grand Opera, are appointed grand officers.

Household Inventions.*

One phase of household economics which should be made more prominent is that of household inventions. Comparing housework with other industries, it is obviously belated in respect to using mechanical devices and labor-saving appliances; for while farming has been transformed by science and invention, and the life of the agriculturist changed from one of plodding drudgery to one of progressive enterprise, the main processes of housework are done to-day just as they have been for many years. Much hard work has been eliminated, it is true, by mechanical arrangements in the building of our houses; by means of waterworks and heating apparatus the heaviest part of the work, the lifting of wood and water, is dispensed with; and much heavy work has gone out of the house to be done by machine operatives in factories; but, confining our attention to the appliances to be daily handled in the inevitable rotary processes of house cleaning, food preparing, etc., we find these generally done in the old ways practiced by our foremothers, and the mechanical devices employed to be few and simple.

The scrub board, the dishpan, the kneading board and rolling pin, the chopping tray and knife, the broom, the mop, the cook stove, the coal scuttle or wood box, still linger. The potatoes are peeled, the peas shelled, the berries hulled, and the fruit seeded by hand in most households, yet invention waits at our doors. There are endless devices for saving steps, for avoiding dust, for transporting things up and down, which might be studied out in the building of our homes and go in with the laths and plaster. The housewife must have her eyes open to this and "boss the job," since the architect views the home chiefly as the social rather than an industrial center, and the carpenter is guided by other considerations than planning to save woman's time. The perfection of a home plant for housework will only be known when the housewife has a head, if not a hand, in the building.

There are many small, inexpensive appliances to be had—carpet sweepers, meat mincers, salad washers, peeling machines, fruit seeders of different sorts. One who has them all will be in danger of being "cumbered with conveniences," but they give better results with less toil than the old ways and should be always at hand. There are also machines for washing things in the aggregate instead of piece by piece; these save much time, wear, and breakage, and are generally successful in the hands of intelligent operatives. Clothes washers and dish washers are favorites with the housewife who does her own work, and will be placed in the hands of household laborers when we learn to estimate intelligence and time value in the kitchen. Speaking from experience, we believe the dish washer saves more time in the average household than the sewing machine and does better work than the average servant.

Besides these, it is our privilege to bring into use a new order of inventions which mean more to the housewife than all that have preceded. These inventions tend to reduce the processes of housework to scientific accuracy and to eliminate the uncertain factors in the kitchen. Now it is quite possible to bring to lawful terms the cook stove and the bread, if not the baby. The use of liquid fuel in the form of coal oil, gasolene, gas, or electricity is now practicable everywhere for cooking and water heating. The construction of heat savers, or non-conducting cases to surround the heating apparatus, and prevent loss of heat by radiation, gives us the reins by which we may hold out heat supply and control it at will. The Aladdin oven and similar inventions which may be constructed for using lamp power and conserving heat by incasing the heating chest in some non-conducting medium, as asbestos paper, are available for all; they may be adapted to cooking on a large or small scale. A cooking thermometer is one of the indispensables of the scientific kitchen. The process of bread making is reduced to an exact science, since by means of the bread raiser and the new ovens, the temperature at which the dough should be kept during the rising and the baking may be perfectly regulated. Material being reliable, the bread maker can depend upon her calculations for uniform success without the eternal vigilance of the old method. The canning of fruit may be made a delightful pastime by using the steam cooker or Aladdin oven with a lamp.

*Hanna Otis Brun, in the American Kitchen Magazine, Boston, January. Condensed for Public Opinion.

Launching of the Helena.

The new United States gunboat Helena and the Plant Company's new merchant ship La Grand Duchesse were launched simultaneously at the yards of the Newport News Shipbuilding Company, Newport, News, Va., on January 30, 1896. The Helena is a flush deck fore and aft schooner-rigged steel gunboat, not sheathed, with a double bottom and closed watertight subdivision at the water line. The dimensions are as follows: Length on load water line (normal displacement), 200 feet; maximum breadth, 36 feet; mean draught (at normal displacement), 11 feet; normal displacement, 1,261 tons; full coal capacity, 380 tons; coal carried at normal displacement, 150 tons. The boat is intended to be manned by 150 officers and men. Propulsion will be by twin screws, actuated by two sets of vertical inverted quadruple expansion engines. An average speed of 14 knots an hour must be maintained for four consecutive hours on the trial trip. The battery consists of four 4 inch guns mounted in the open on the upper deck, two being placed forward and two aft in pairs on opposite sides of the ship; four 4 inch guns in armored sponsons on the gun deck, two on each broadside amidship; four 6 pounder Hotchkiss guns, two forward and two aft in 1 inch armored sponsons. In addition to these, the boat will carry one pounder Hotchkiss and Gatling guns on the main deck and it is provided with a bow torpedo tube.

Incrustation in Gas Engine Jackets.

It is not often that trouble is experienced in gas engines owing to incrustation by lime deposited from the jacket-cooling water, but a case is reported where, in two engines, one of 25 and one of 50 horse power, after having been in operation for about a year, different parts, notably the exhaust valves, were frequently found to be very much overheated, the circulation of the cooling water through the cylinder jackets was impeded, and there were often premature explosions of the gas and air charges in the cylinders. On taking the engines apart, it was found that portions of the water pipes leading to and from the jackets, and even the interior of the jackets themselves, were almost completely choked up with a scaly deposit formed by the precipitation by heat of salts dissolved in the water, the action being in all respects similar to that going on in a feedwater heater. Since, however, as shown by thermometric measurements, the cooling water, in flowing through the jackets while the engines were working, never reached the temperature at which lime salts are known to separate from the water which holds them in solution, it became evident that the precipitation must have occurred during the periods just after the engines stopped working.—Water and Gas Review.

Firing the Indiana's Big Guns.

On a recent run of the battleship Indiana from Newport to Hampton Roads, all the guns of her battery, including the 13 inch rifles, were fired. It was the first time they were fired on board ship, and the test showed that the gun mounts and their installation were entirely successful. Such a result was to be expected; so the test was not so important in this respect as it was in another, namely, the effect of the blast of the heavy guns.

The recent test showed no damage to woodwork or glass, nor any serious injury to the officers and men engaged in the firing, but it was conclusively demonstrated that in certain positions of the turret the man in the sighting hood would be exposed to serious discomfort and sometimes actual injury when the 13 inch gun was fired.

The heavy guns of the monitor Amphitrite were fired in the same manner, to ascertain the effect on her structure and on living animals placed under the decks over which the guns were fired. It was found in her case that no injury resulted to the ship with 12 inch guns, nor to the animals, so far as observed.

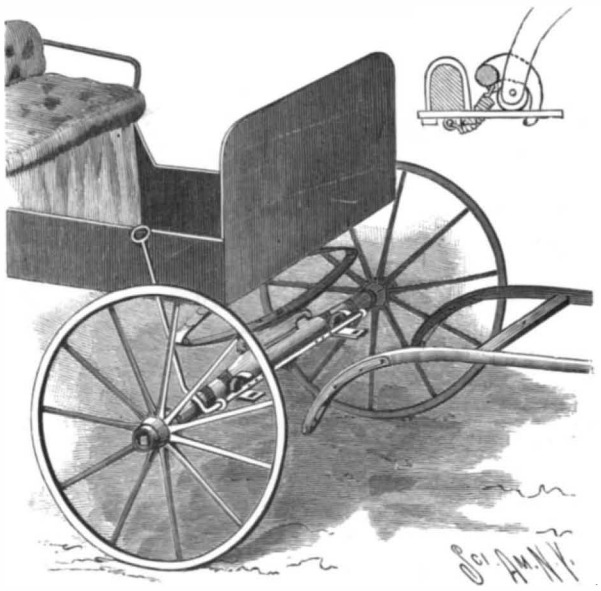
Keeping Store Windows Free from Frost.

In large stores a great deal of trouble is sometimes caused by frost forming on the plate glass windows. In Chicago the electric fan has been put into service to avoid this condensation of moisture. The fans are kept going continuously and the current of air seems to carry off the moisture before it can condense and freeze on the glass. It is a new version of the old ventilation cure for the same trouble.

© 1896 SCIENTIFIC AMERICAN, INC.

A HORSE DETACHING DEVICE.

To conveniently free a runaway horse from a vehicle, the attachment shown in the accompanying illustration has been invented and patented by Joseph Friedlander, of No. 219 West Commerce Street, San Antonio, Texas, the device being serviceable also for guiding the vehicle after the horse has been freed from it. In bearings secured by clips to the front axle is journaled a shaft from which a handle bar extends up to within convenient reach of the driver, and on the shaft are hooks, each adapted to enter a slot or opening in a forwardly extending keeper plate clipped to the bottom portion of the axle. The hooks may be formed integral with the shaft, or they may have on their heel portions screw shanks

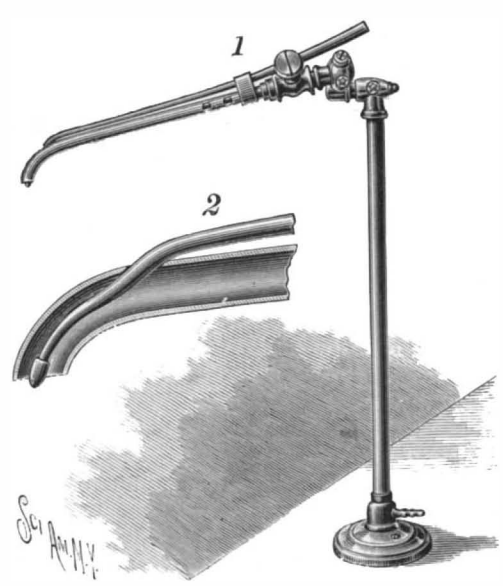


FRIEDLANDER'S HORSE DETACHING DEVICE.

adapted to engage threaded apertures in the shaft, thus facilitating the adaptation of the device to vehicles having thills at different distances apart. The thill irons preferably have at their lower ends rollers, as shown in the small figure, and when the handle bar has been moved backward to lift the hooks the thill irons are placed on the keeper plates, a spring connecting the hook shaft with the axle then returning the hooks to the plates immediately upon the release of the handle bar. The slots in the plates may, if desired, have rubber cushions to assist in holding the hooks in engagement with the plates and to prevent rattling. In case of a runaway horse or team, the moving rearward of the handle bar, as shown in the illustration, releases the thills from the vehicle, the driver then keeping hold of the hand bar to guide the vehicle until it comes to rest. This inventor has also applied for a patent on a vehicle brake especially designed for use in connection with the horse detacher.

WALMSLEY'S IMPROVED COMPOUND BLOWPIPE.

This blowpipe is so constructed as to make it specially adapted for plumbers, dentists, and jewelers, giving an exceedingly fine and non-oxidizing flame, making it unequaled for lead burning, using illuminating gas and a flux of soldering salts. It has been patented by Mr. T. B. Walmsley, of No. 905 East 149th Street, New York. It is made in two forms, on a stand, as shown, and without the swivels, so



WALMSLEY'S IMPROVED COMPOUND BLOWPIPE.

that it can be used by hand, as in lead burning. The process of lead burning is a new one, and is given in conjunction with the oxyhydrogen process at the New York Trade School, by Mr. Walmsley, as instructor at that admirable institute.

It is well adapted for the use of dentists and jewelers, as the flame is very fine and cannot be blown out—a fault common with other compound blowpipes. It also has several blowpipes of different sizes, which can be put in position at once to suit the work engaged on. It will be seen that no regulating cock is used on the blast, the difference in size of the blowpipes enabling the workman to get the desired flame by regulating the supply of gas. It may be well to mention that natural or gasolene gas can be burned as well as illuminating gas.

By using a blowpipe in connection with illuminating gas and a flux of Yager's salts a first rate job of lead burning can be done, such as the lengthening of traps and bends and lining of tanks or sinks, where the seams can be burned flat. It will be found easier to the amateur to practice this form of burning than by the oxyhydrogen process, and all the lead burning needed in practical plumbing can be done by this process.

Sheet Lead, Butt Seam.—Fit the edges close and clean, ¼ inch wide, with shave hook. Apply the flux with small pencil brush and regulate the flame to suit the thickness of lead to be burned—3 and 4 pound sheet lead, the flame should be very fine, not thicker than $\frac{1}{16}$ inch; 5 and 6 pound lead, ⅛ inch flame is suitable. If the mouth is used for the blast, blow easily until the lead begins to fuse, then give a circular motion to the flame, and fusion will be complete. The blowpipe should be kept 2 inches from the lead to get the proper heat from the flame.

In using a foot bellows, more care will have to be taken to prevent burning a hole in the lead. The flame must be used more quickly than when the air blast is supplied by the mouth.

Sheet Lead, Lap Seam.—In preparing this seam care must be taken to shave both upper and underneath side of lap, also surface of bottom, allowing the cleaned surface of bottom to project ¼ inch. Cut a strip of lead ¼ inch wide and use when burning this seam, holding the strip across the seam, melting ¼ inch at each movement and in advance of the preceding drop.

Lead Pipe Burning, such as Lengthening of Traps and Bends.—Cut both ends so as to fit close, and with a fine rasp bevel the inside of one end its own thickness and repeat the same on the outside of the other piece; this will give a perfectly smooth interior of the pipe. Shave ¼ inch on each piece, making a ½ inch seam. When possible, it is better to use a wood plug or a piece of iron pipe covered with paper when burning; fuse carefully all round, and if the pipe is to be exposed, it can be loaded by using a strip of lead, as in the lap seam, and finished off with a fine file and sandpaper, entirely concealing the point of juncture.

Burning Lead and Brass.—Carefully tin the brass and wipe off clean all surplus solder and slip the brass coupling or ferule ½ inch inside the pipe. Begin by fusing the lead and brass, using freely of flux and letting the greater heat dwell on the brass. A strip of lead can be used to finish this joint when needed. In all cases when burning, keep the blowpipe 2 inches or 2½ inches from the seam, and fusing will the more readily take place. A very little practice is needed to burn a good seam.

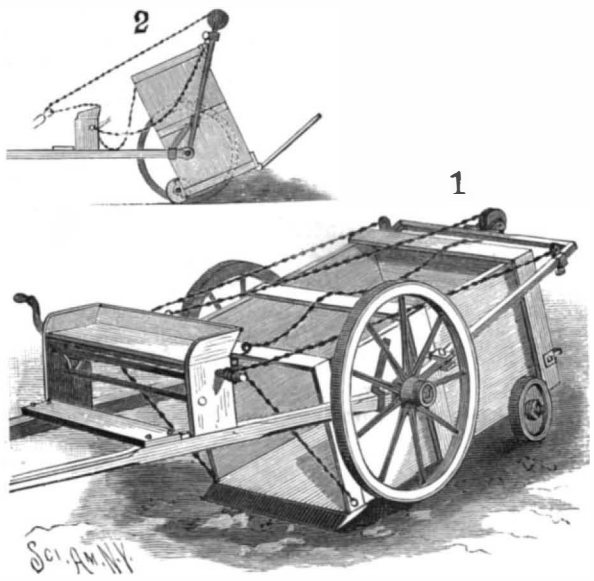
Employer's Liability.

The Supreme Court of Minnesota held, in the recent case of Carlson vs. Northwestern Telephone Exchange Company, that the decisive tests as to whether, in any given case, an employe is to be regarded as a vice-principal or a fellow servant is not his title or his rank, but the nature of the service which he performs; that if he is authorized to perform duties which are the absolute duties of the master, he is to the extent of a discharge of those duties a vice-principal, and that whenever the nature and magnitude of the master's work, whether it be that of construction or otherwise, are such that it is necessary that orders be given regulating the conduct of his employes and directing them where to work, it is not only right but the absolute duty of the master to give such orders, and in obeying such orders the employes have a right to assume that the master, in giving the orders, has exercised due care for their safety. In the case before the court it appeared that the defendant in excavating a ditch placed the work and the men employed thereon, of whom the plaintiff was one, in charge of a foreman, who had general oversight of the work. The men were subject to his orders; he had authority to employ and discharge them and direct them what to do and where to work, and was the supreme authority there present. The foreman negligently ordered the plaintiff from the place where he had been working into the ditch at a point where he had not previously worked, which was a place of unusual danger by reason of a crack in the earth on the side of the ditch and defects in the curbing, which danger and defects were not obvious or known to the plaintiff, who obeyed the order and was injured by the caving in of the ditch. The court held that in giving the order the foreman was a vice-principal and the defendant liable for his negligence.—Bradstreet's.

LONDON barometers on January 9, 1896, showed a pressure of 30·934 inches at 9 P. M. Only four times in a hundred and fifty years has a height above 30·9 inches been recorded. On the same day, near Chester, the barometer reached 31·013 inches.

A SNOW AND DIRT REMOVING CART.

A cart designed to act as a scraper in taking up snow and dirt, as well as afford an efficient vehicle for removing and dumping them, is shown in the accompanying illustration, and has been patented by J. R. Hawkins, of Mountainville, N. Y. The cart is preferably of sheet metal, having a scraper at the front end of its bottom, and is mounted on short axles extended from the ends of a U-shaped frame which has on its side bars adjustable trunnions engaging the sides of the cart body, permitting the latter to swing, the rear ends of the shafts being journaled on the axles, and the shafts supporting a seat for the driver. At the front lower corners of the cart body are eyes engaged by hooks on chains which extend up to the

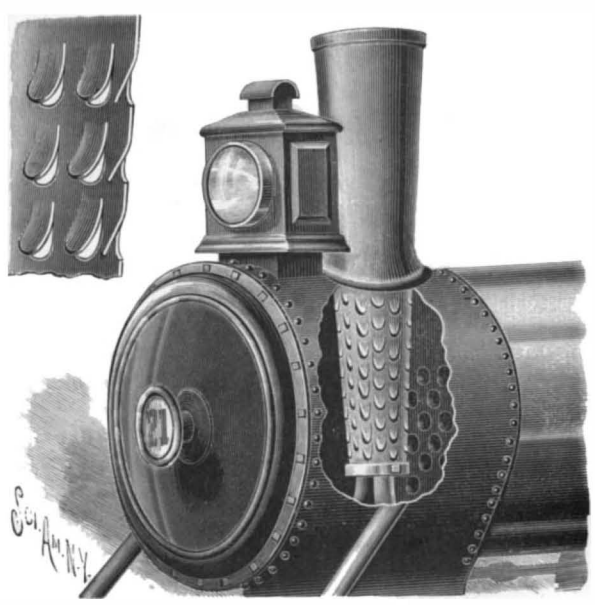


HAWKINS' SNOW AND DIRT CART.

seat, preventing undue dropping of the scraper when the street surface is uneven, and at the rear are small wheels to support the bottom of the cart body at the slight inclination necessary to facilitate the scraping up of dirt or snow from the street surface. To load the scraped up material into the rear part of the cart body, the driver swings the front end of the cart body upward by means of a chain or rope extending rearward from the seat, and passing around a pulley attached to the middle part of the U-shaped frame, the lower run of the chain extending forwardly to a cross bar. On letting go the chain the cart body again swings downward to the position shown in Fig. 1. To dump the contents of the cart, as shown in Fig. 2, chains attached to the rear end of the U-shaped frame are extended to a winding shaft under the seat, and the turning of a crank shaft elevates the rear end of the frame, its movement being checked by stops adjustably held on the shafts. After the frame has been swung up, the winding shaft may be locked, and the other chain pulled upon by the driver to cause the cart body to swing on its trunnions, insuring the complete dumping of the contents.

A LOCOMOTIVE SPARK ARRESTER.

A device designed to prevent the escape to the smoke stack of sparks and cinders, while permitting the free



SOLOMON'S SPARK ARRESTER.

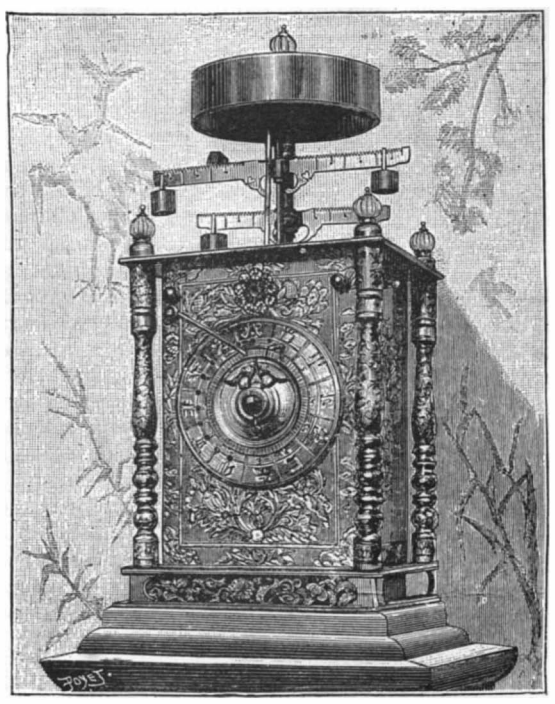
passage of the products of combustion, is shown in the accompanying illustration. It has been patented by Edgar J. Solomon, of Carlinville, Ill. To the exhaust nozzle is fitted the lower end of a conical tube whose upper end fits into the lower end of the smokestack, and in the sides of the tube are U-shaped slits, having tongues of metal, which are pressed inwardly as shown in the small figure. The gaseous portions of the products of combustion pass freely upward to the smokestack, while the solid portions, striking the tongues, are thrown back into the smoke box.

© 1896 SCIENTIFIC AMERICAN, INC.

AN INTAKE AND FILTER FOR WATER SYSTEMS.

For conveniently filtering large quantities of water and readily cleansing the filtering bed the arrangement shown in the illustration has been devised by and forms the subject of a patent issued to H. L. Ricks, Eureka, Cal. In an open top casing arranged in the bottom of a stream is a longitudinal division formed by slats resting on cleats, and supporting the filtering material, through which the water passes to a settling basin below. The discharge pipe, connected with a reservoir or pump, and adapted to supply water mains in the usual way, leads from the lower end of the settling basin, where it is provided with a strainer, and in its course through the ground is provided with a check valve, beyond which is a branch pipe leading upward into a tank. The branch pipe has a ball valve where it enters the tank, to prevent any backward flow of water through this pipe, and the tank is sufficiently elevated to afford the necessary pressure for efficiently flushing the filtering bed. Arranged vertically in the tank is a casing in which is a pipe connected with parallel perforated pipes embedded in the filtering material, and through these pipes, when the tank is nearly filled, water will be discharged with sufficient force to wash the impurities from the filtering material. The tank may be filled by the back flow of water through the discharge pipe, such flow being interrupted and turned into the tank by means of the check valve, or, where the discharge pipe is connected directly with the pump, a tank near the pumping station may be connected with the flushing tank.

Where the discharge pipe is of considerable length, and is higher at certain points, rendering it likely that air will collect in such portions of the pipe, branch vertical pipes are here located, as shown in the small view, there being in each pipe a rubber ball valve designed to exclude the air when back flushing and clear the intake at high places.



RICKS' INTAKE AND FILTER.

JAPANESE CLOCKS AND POCKET SUN DIALS.

The Japanese iron clocks of the seventeenth century were cubical in shape, like the European ones of the sixteenth, and differed therefrom only in the engraving of their surfaces and in the disks of their dials, which were usually of metal lacquered in different colors, with the hours gilded. Later on, this form of clock, with the case inclosing the movement, was made entirely of copper and of smaller size. Along with those engraved on the solid surface, there were some made in openwork, engraved and of delicate ornamentation.

Columns worked on the lathe, engraved and even enameled, ornamented their angles (Fig. 1). Toward the eighteenth century such clocks were placed in cases of various forms, as was done in Europe. The most beautiful were those mounted upon legs, so as to allow the weights to descend (Fig. 2). These were of porcelain, wood and lacquer work.

The most common form was a sort of truncated pyramid, the four sides of which were solid and of natural or lacquered wood, and upon which the clock was placed. Sometimes the latter was inclosed in a glass case surmounting the pyramid. An aperture at the base of the latter permitted of winding up the weights, which were of copper or lead, and hemispherical, lenticular or cylindrical in shape.

In the pieces mounted upon legs, the weights were often concealed in tassels of the same silk as the cord that sustained them.

There were still other kinds of cases in which the clocks were placed, which in form resembled the Dutch clocks of the seventeenth century, and which, like them, were suspended from the wall. They were of wood, and were provided at the sides with pretty little glass doors, and the whole was supported by two brackets (Fig. 3).

In the two kinds of cases that we have just mentioned, apertures were formed at the top, upon three faces, in order that the sound of the bell placed at the upper part of the clock might be distinctly heard. They were lined internally with some sort of fabric to prevent the entrance of dust.

Other forms of clocks, which may be called vertical (Fig. 4, No. 1), were absolutely Japanese in the arrangement of the case and movement. They consisted of a glass case surmounting a very long rectangular body. The material was wood. The movement, placed in the case, was entirely open. The decoration consisted in an engraving or chasing of the front pillar plate and in small columns of metal placed at the angles. Some of these copper pillar plates were beautiful in design, being in lace-like openwork and finely engraved. Others were chased with the greatest care, and certain of them, even, by masters who were not afraid to sign their names. We own one bearing the name of Kouniyouki (Fig. 4, No. 5).

The vertical cases all bore much resemblance to one another. At the base there was a small drawer, for the reception of the key. These pieces were suspended from the wall.

The movable cartouches, twelve in number, upon which the hours were engraved, and which constituted the dial, were likewise nearly all of the same form. The dial therefore consisted of these twelve cartouches placed upon the long strip of wood forming the cover of the case that contained the weight, to which latter was fixed a style whose form varied to infinity. This style, mounted upon a rod fixed to the weight, descended in a slot formed near one of the sides of the case, in proportion to the running of the clock work. The twelve metallic cartouches above mentioned were mounted in such a way that they could be regulated by hand conformably to the hour that they were to indicate. The most scientific of the vertical dials were those with lines engraved upon the piece serving as a dial, which, in this case, was of copper.

Upon this plate were engraved twelve vertical lines that corresponded to the twelve fortnights of half a year. Twenty-four curved lines arranged horizontally

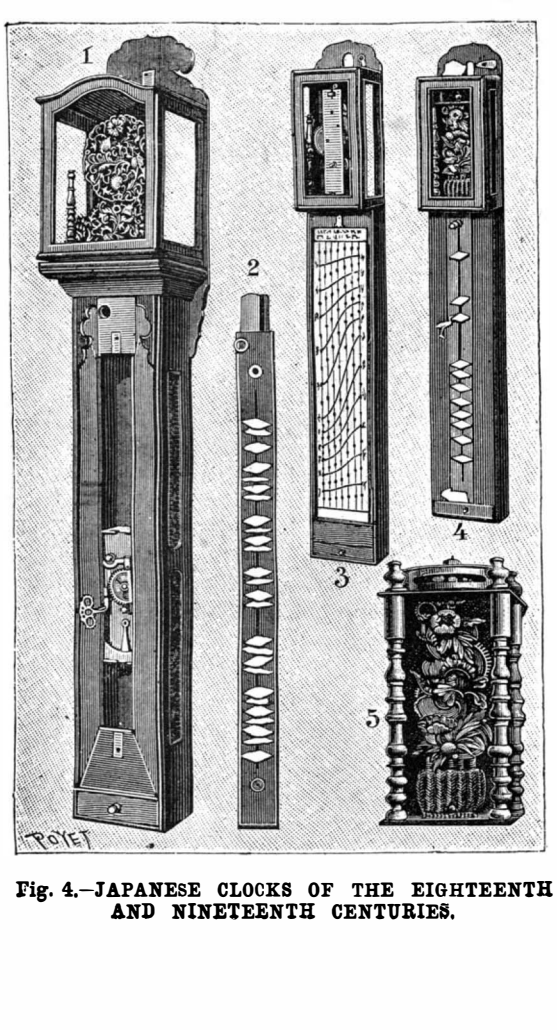


Fig. 1.—JAPANESE CLOCK OF THE EIGHTEENTH CENTURY.

Fig. 4.—JAPANESE CLOCKS OF THE EIGHTEENTH AND NINETEENTH CENTURIES.

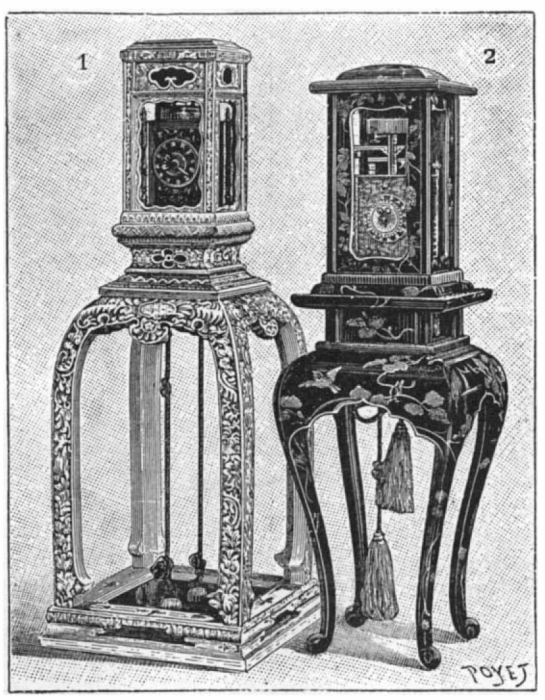


Fig. 2.—CLOCKS MOUNTED UPON LEGS.
No. 1. Porcelain. No. 2. Lacquer work.

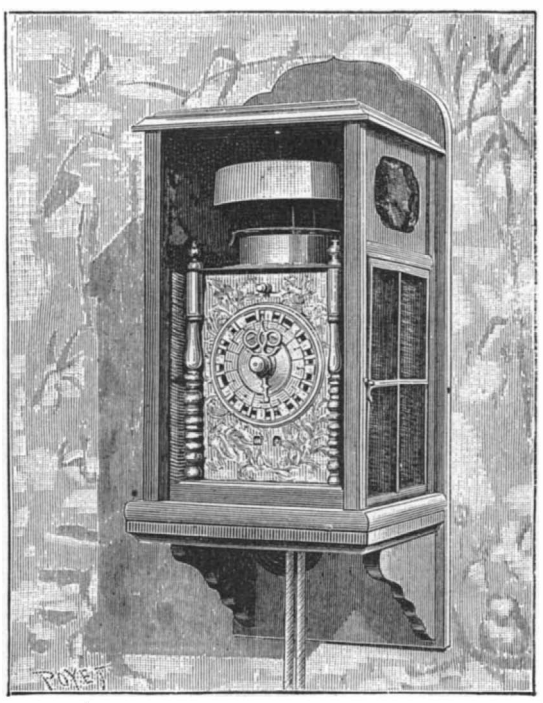


Fig. 3.—JAPANESE WALL CLOCK.

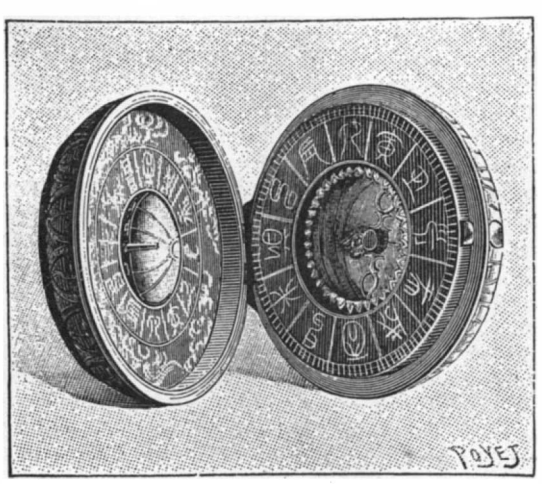


Fig. 5.—JAPANESE POCKET SUN DIAL.

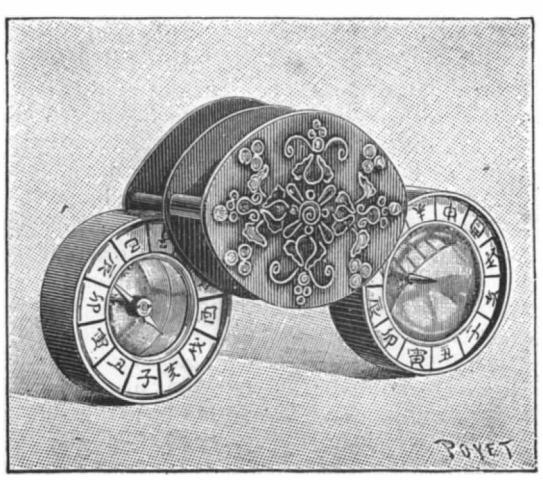


Fig. 6.—JAPANESE POCKET SUN DIAL OF THE EIGHTEENTH CENTURY.

© 1896 SCIENTIFIC AMERICAN, INC.

indicated, through their intersection with the vertical ones, the hours and half hours of a day. The horizontal lines had curves that receded from each other progressively in one direction and approached each other in the other, and this permitted of measuring the difference of the days and nights from each other in length. During six months of the year the hour was read in one direction and during the six others in the opposite direction (Fig. 4, No. 3). In this way were obtained the long and the short hours, according to the season.

The intersection of the curves with the perpendiculars marking these different hours was indicated by a light, rectilinear bar placed horizontally upon the engraved plate. This was mounted upon the weight and operated like the index of the vertical dials above mentioned. Japanese clocks struck the hour and the half hour, but there was here a curious peculiarity that we shall describe.

The primitive clocks had the European striking train that struck from one to twelve, with or without the halves. Afterward, the Japanese divided their striking trains so that they corresponded with their hours, that is to say, in counting from 9 to 4 without the halves.

Finally, they made the trains in such a way as to strike the halves, as follows: The half hour was sounded alternately by one stroke or two strokes. For example, in order to indicate half past nine, the train struck one; for half past eight, it struck two; and for half past seven it struck one again, and then two for the following half. This system had one advantage that explains itself. The hours in Japan correspond to two of ours, since only twelve a day are reckoned, instead of twenty-four. The periods of the hours are sufficiently distant from sunrise to sunset to prevent the single stroke or the two strokes of a half hour from being confounded. They serve, on the contrary, to render precise the half of the hour to which it corresponds.

In certain clocks of vertical form the Japanese have conceived the ingenious idea of using a striking train actuated by a spring as a motor for the movement. This train includes a pawl which, at every hour and half hour, meets the prolonged rods of the twelve cartouches upon which the hours are engraved and twelve other cartouches that are ornamental, and are interposed between the preceding and indicate the halves. The pawl, lifted by these rods, causes the striking train to operate. The weight of the train is wound up every day to the top of the case that incloses it, and here the square of the remontoir of the spring of the train presents itself opposite an aperture in the dial, and the spring is coiled with the same key that serves to wind up the cord of the clockwork movement (Fig. 4, Nos. 1 and 2).

We shall explain, according to Kaempfer, how the time of night was announced to the public in Japan.

In certain cities the watchmen did this by striking two wooden cylinders against each other. In others, different instruments were used. Thus, the first hour after sunset was made known by beating a drum; the second, by beating a gum-gum—an instrument in the form of a large flat basin, which, upon being struck, made a loud and piercing noise; and the third, or midnight, by ringing a bell, or rather by striking it with a stick of wood. Then they began over again for the following hours. The sounder, or awakener, whose duty it was to measure the time, was the lowest of the public officers.

The bell that sounded the hours of the day was often that of a temple. It was the rising and setting of the sun especially that was announced with the most care.

Along with mechanical clocks, the Japanese used portable sun dials, some of which had the form of a watchcase (Fig. 5). To the center of one of the halves of the case was fixed a small gnomon, the shadow of which reached the plane surface of the periphery, which latter, according to the Japanese system, was divided into twelve hours. The other half of the case carried in its concavity a magnetized needle, which oscillated freely in the horizontal plane. Beneath this needle there were four characters, which were 90 degrees distant from each other and designated the four cardinal points. The circular plane surface of this half of the case was divided into twelve parts, corresponding to those of the opposite side and marked with the same numbers, but in inverse order. In order to make use of the sun dial, it sufficed to orient it by means of the magnetized needle, and the direction of the shadow of the little style would then permit of estimating the time more or less approximately. Other sun dials consisted of two hollow disks, one of them containing the compass and the other the style. These two parts folded one over the other and entered a case to which they were jointed (Fig. 6). This arrangement is essentially Japanese. The other form has often been made for Japan in Holland.

The Japanese have as a proverb: "The style and the disk, despite their great utility, are not as valuable as an inch of shadow."

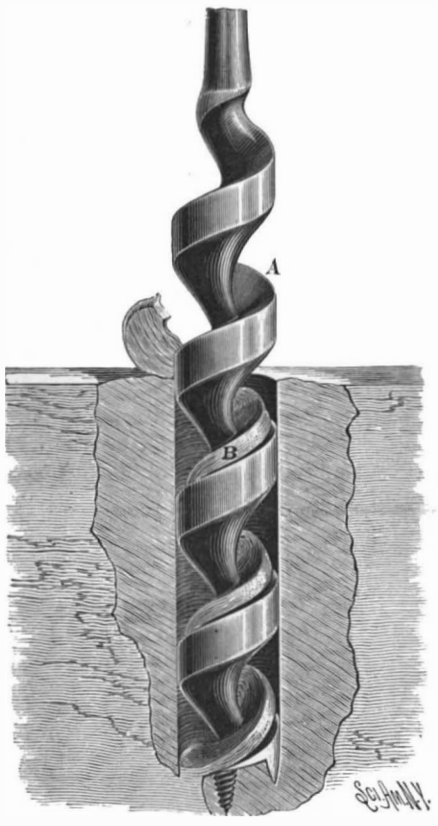
The sun dials of which we have spoken, as well as the clocks that we have described, are manufactured by clockmakers, who are called in Japanese tokei, while their shops are styled to-kei-yo.—La Nature.

AN IMPROVED BIT.

We illustrate the Ford patent bit, a tool which has been subjected to thorough testing upon different kinds of wood and which has a distinguishing peculiarity over other bits, which lies in the twist.

Its shape is determined by and defined as that of a single concaved twist. This gives it a single cutting edge and a single projecting lip. The thread of the screw point is a continuation of the twist of the upper part, so that one merges into the other. The concave shape of the upper surface of the twist has the effect of drawing the borings toward the center or axis of the bit, thus preventing friction of borings against the sides of the hole, and thereby also preventing choking. For this bit, the necessity of constantly withdrawing for removing the chips does not exist. The cut shows the self-cleaning action of the tool, and also presents its general shape. The drawing was made from an actual boring with the bit, the hole being made one-half in each of two separate pieces of wood, which were then separated to give the model for the artist and to show its action.

The bits were tried in different kinds of wood vertical to the grain, diagonal thereto, and in other ways. The straightness of the hole was also remarked, and the absence of any tendency to split the wood was an evidence of the good clearance. The screw point



AN IMPROVED BIT.

held its grip very well, no pressure whatever being required for the feed, even in end grain boring. The action of the edge is a true cutting one, not a scraping one. The Ford Bit Company, of Holyoke, Mass., are the manufacturers.

Improved Calorimeter.

An improved calorimeter, for the application of the method of mixtures in determining specific heats, is described by Mr. F. A. Waterman in the Philosophical Magazine. Mr. Hesehus' ingenious suggestion is acted upon, to maintain the calorimeter, after the introduction of the heated body, at a constant temperature by means of cold water, instead of measuring the rise of temperature of the calorimeter. This arrangement gets rid of the radiation error, and eliminates the "water equivalent" of the vessel. By dropping the cold water in, stirring is also made unnecessary. The method has been placed by Mr. Waterman upon a footing of equality at least with other methods, but his success may be partly due to other improvements. The body experimented upon is heated by a coil of wire conveying a current, and surrounded by ice. The initial temperature of the body may thus be regulated by simply maintaining the current of a certain strength and this temperature can be kept constant for five or six hours together to within 0·1° C. The body is then plunged into a silver calorimeter surrounded by the bulb of a delicate air thermometer indicating a difference of temperature of 0·01° C. The cold water is contained in a copper vessel having the shape of an inverted cone surrounded by ice. In this manner the ice cannot melt away and leave a free space round the vessel. The water dropping arrangement and the electric heater are mounted on vertical axes in such a manner that they can be quickly swung into position just above the calorimeter. After the heated solid or liquid has been dropped in, the water dropper is set to work, at first rapidly, and then slowly, until the body has assumed the original temperature of the calorimeter. For bodies of the same weight and the same initial temperature, the specific heat is then, Nature says, simply measured by the amount of ice cold water necessary to cool them to the temperature of the room.

Acetylene for Steam Engines.

The use of acetylene for the production of power has been suggested several times since it has become a commercial product; but Dr. A. Frank, of Charlottenburg, has stated its advantages and disadvantages for the purpose very explicitly in the Journal fur Gasbeleuchtung. Calcium carbide capable of yielding 90 per cent of the theoretical amount of acetylene which the pure carbide should give is now obtainable from the works of Bitterfield; and a very good article is also now made at Neuhausen. Dr. Frank suggests that the carbide furnishes an excellent means of transporting power (derived from water for instance) to a distance from the source. He considers Herr Ihering's proposal to compress acetylene to a liquid at a pressure of 50 atmospheres for transportation a less practicable one than that of conveying the calcium carbide itself. He bases this conclusion on the following figures: 64 parts (by weight) of calcium carbide on addition of water should produce 26 parts of acetylene; or 100 pounds of calcium carbide should yield 40·62 pounds of acetylene=559 cubic feet at atmospheric pressure. The liquefied compressed acetylene weighs 28·15 pounds per cubic foot, or 40·62 pounds occupies 1·443 cubic feet; while the calcium carbide necessary to produce this quantity will have a volume of only 0·722 cubic foot, taking its specific gravity of 2·22. The volume of the calcium carbide is therefore about half that of the acetylene gas it would yield, when the latter is stored as a liquid under a pressure of 50 atmospheres. The space occupied by the walls of the containing vessel is, moreover, unconsidered in this comparison of volume. But the commercial production of acetylene from the carbide only gives 90 per cent of the theoretical yield; and therefore 111 pounds of carbide would be required to produce the 40·62 pounds of acetylene, and a space of 0·800 cubic foot would be occupied by it. The calcium carbide may be run into cubical or other rectangular blocks; and these may be put into light tins for protection from the air and moisture. The liquefied acetylene, on account of the weight and shape of the containing vessel, needs more space than the carbide for its storage.

The liberation of the acetylene from the roughly powdered carbide may be effected with simple apparatus. It may be observed that recent experiments show that the toxic properties of acetylene have been much overrated. Small mammals can remain for half an hour in an atmosphere containing 4 per cent of acetylene without perceptibly suffering inconvenience. Slight leakages from the generating apparatus need not, therefore, be regarded as dangerous to the workmen. If a comparison of the weight and volume of coal, liquefied acetylene, and calcium carbide needed to provide power for a 1000 horse marine engine for 25 days is made, the following results:

1. COAL.—The 600,000 horse power hours will need, at 1·543 pounds per horse power hour, 413 tons of coal, occupying, when well stowed, a space of 14,800 to 15,200 cubic feet.

2. LIQUID ACETYLENE.—According to Ihering and Slaby's figures, 0·4 pound nearly is required per horse power hour with large engines, or 106 tons for 600,000 horse power hours. A specific gravity of 0·451 at 0° C. corresponds to 364 at 35·8° C. (about the temperature of the ship's hold); and therefore 106 tons would require vessels of 9,500 to 10,600 cubic feet capacity, and these to be absolutely safe at a pressure of upward of 50 atmospheres.

3. CALCIUM CARBIDE.—The corresponding amount of 90 per cent carbide would be 295 tons, which, at a specific gravity of 2·22, would occupy a space of 4,625 cubic feet; or, allowing for the tins in which the blocks are stored, about 5,300 cubic feet.

Therefore to supply power for 25 days to a 1,000 horse power engine requires: Good coal, 413 tons, having a volume of 14,800 cubic feet; compressed acetylene, 106 tons, having a volume of 9,890 cubic feet; or calcium carbide, 295 tons, having a volume of 4,770 cubic feet. Moreover, coal needs a boiler which is expensive both in first cost and in maintenance; while liquid acetylene requires large storage vessels, whereas simple apparatus only is needed with the carbide. To one unversed in shipbuilding, it seems that, in the endeavor to find a very concentrated form of fuel to fit war vessels for long journeys, calcium carbide must attract attention. Stationary and locomotive engines on land might also use it, and be independent of foreign petroleum, which has lately also been used for ships' boilers.—Journal of Gas Lighting.

WHAT is claimed to be the largest single pane of glass in the country was received at Hartford, Conn., from Belgium recently. It is 12½ feet high, 15½ feet wide, ½ inch thick, and weighs 1,800 pounds.

© 1896 SCIENTIFIC AMERICAN, INC.

ROENTGEN OR X RAY PHOTOGRAPHY.

The discovery of X ray photography by Roentgen will serve not only to immortalize the physicist who so fully developed it before giving it to the public, but it will render the year 1896 distinguished as the "Roentgen photography" year, as 1894-95 are distinguished as the "argon and helium" years. It seemed as if the limits of human discovery were being reached, but the wonder of the new photography only emphasizes the possibility of other victories to be won in the world of science. It was by aid of a fluorescent medium that the course of the rays was traced and the proof of their penetration of solid opaque organic screens was reached.

Roentgen's first experiment consisted in placing near a Crookes tube, which was enveloped in black paper or pasteboard, a screen whose surface was charged with a fluorescent substance. On exciting the Crookes tube, the surface of the experimental screen became luminous. A book of a thousand pages was placed between the tube and the screen, but the luminosity persisted. Wood and aluminum were also tried with like result, and it was found that if the hand were interposed the image or shadow of its osseous skeleton was obtained on the fluorescing and luminous surface. To try the effect of the newly discovered rays upon a photographic plate was but natural. It was tried, a photograph through an opaque screen resulted and the discovery was complete. This account disposes of the story of the discovery having been made accidentally.

The experiments, as described by Continental authorities, require a coil giving a spark from 2·4 to 3·2 inches long. Four inches is named as a good distance to intervene between the Crookes tube and the sensitized plate, and ten to twenty minutes are given as the limit of exposure. We publish in the SCIENTIFIC AMERICAN SUPPLEMENT of this week, No. 1050, Roentgen's photograph of the bones of the human hand. An interesting feature in it is the ring on the finger. The metal cuts off the rays far more than do the bones, as the latter cut them off more than the muscular tissue or epidermis does. Hence in graduated intensities we find shown the full outline of the hand in light color inclosing the darker outline of the bones, while the metal ring shows darker than all.

It is with no small gratification that we are able to put before our readers the exact details of the experiment, as carried out by Prof. A. W. Wright, of Yale University. He was among the first of the American experimenters, and his results figure as among the most successful ones yet obtained.

The arrangement of the apparatus is clearly shown in the front page engraving, which was prepared from sketches made by our artist in Prof. Wright's laboratory.

On a clamp support is carried the Crookes tube. Prof. Wright used one of approximately spherical shape of the type originally used by Prof. Crookes to show the dependence upon the negative pole of radiant state phenomena. The tube was experimented with in two positions, the plate or one of the wires being made the cathode, the bulb being always so placed as to keep the cathode uppermost.

The excitation was furnished by an induction coil, the primary of which was excited by a five-cell storage battery and the secondary was taken as giving 200,000 to 300.000 volts potential, corresponding roughly to a spark length or distance between electrodes of two to three inches in air. Wires from the secondary were connected to the terminals of the Crookes tube as shown, the negative wire to the upper electrode.

On the table, a few inches below the tube, the sensitized plate contained in an ordinary plate holder was placed, and on its slide of ebonite were placed the objects to be photographed. They were a purse with coins in it, a box containing aluminum wire weights, a pasteboard pill box in which some balls of different metals were placed embedded in cotton, medals and coins, and a lead pencil. The tube was excited for some minutes, the plate was removed and developed, and the results are shown in a reproduction of the photograph which Prof. Wright furnished us. This photograph is of the highest interest. It shows the objects detailed above. On one side can be seen the dim shadow of a box with the bent wire aluminum weights in it strongly outlined; the pencil shows the lead through the wood; the purse reveals its contents; the box with the little metal balls does the same, while the coins produce at least their contour. All these effects were produced through the ebonite cover of the plate holder. The plate used was a very rapid Cramer dry plate; the image was developed with eikonogen.

The photograph we reproduce possesses historical interest, as being one of the first of the Roentgen photographs produced in the United States.

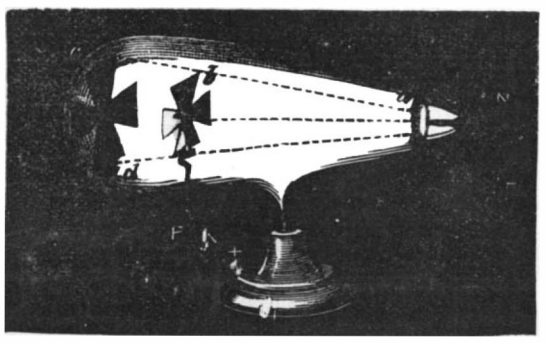
From Prof. Wright we have received the following latest particulars concerning the details of his experiments:

"A curious peculiarity of the plates which have been subject to the cathode rays, as compared with those which have been acted upon by light, is their great sluggishness in development. The image does not appear at all for a relatively long time, and then comes up very slowly, so that the development must be continued a very long time to bring out all there is in the picture. When this is fully out a remarkably strong and dense negative results, with very strong contrast. Cramer and Seed plates of the highest degree of sensitiveness have been used in the later experiments. The time of exposure may be shortened by placing the objects on sensitive plates nearer the Crookes tube, but the definition in the picture is then not so good. The plates should be opposite the cathode."

At the meeting of the Royal Photographic Society, in London, on January 21, Mr. J. W. Gifford, of Chand, showed a number of Roentgen photographs which he had produced, using five to ten minutes' exposure. He stated that he had obtained somewhat similar results without a Crookes tube, using the sparking electrodes of an induction coil to photograph a hand inclosed in a box with a photographic plate.

It is some eighteen years since Crookes tubes were prominently brought into service. They are simply tubes or vessels of thin glass into whose walls platinum wire electrodes are sealed hermetically and which are then exhausted to a very high degree, to about one millionth of an atmosphere. The tubes are of different shapes, to enable different experiments to be performed with them. We reproduce, from an article on Crookes tubes in our SUPPLEMENT, No. 189, of August 16, 1879, a view of one of the tubes, which is of special interest, as showing the production of a shadow by a cathode discharge. The cross is made of sheet aluminum. The cathode connection is made at N, the anode at P. The walls of the tube become luminous under the effects of the discharge, with a shadow of the cross projected on them.

While the shadow shown is of a certain interest from the point of view of analogy, it must be remembered that the X rays are distinguished by Prof.



CROOKES TUBE, SHOWING SHADOW.

Roentgen as sharply from cathode rays as from ordinary light rays. Light rays can be refracted or bent from their straight course by passage from one medium of transmission into another, they can be reflected from surfaces of substances which they cannot pass through. The cathode rays can be bent to right or left out of their straight course by a magnet: but the X rays act most anomalously. While transmitted with varying facility by different substances, some being opaque to them, others transparent, and while these different substances vary in degree between full opacity and almost full transparency for the rays in question, neither reflection nor refraction of X rays has been absolutely proved to exist. A very small index of refraction has been indicated, not shown, for the rays, and an imperfect demonstration of reflection has been made. In their simplicity and directness of action they even suggest gravitation, except that there is no screen for the universal force.

There is now opened a limitless field for experiments, possibly special plates, prepared with fluorescent or other compounds in the emulsion, may be used, and the extension of the scope will interest the professional world from surgeon and physician to metallurgist and engineer. Every day brings accounts of new experiments, it being proposed even to take a photograph of a man upon a plate large enough to receive the shadow. It is said that a negative plate six feet high is being prepared with that object.

The non-refractability of the rays makes it impossible to produce a reduced image; every object photographed as it is done by radiant energy directly must be done by its shadow, and the shadow must be practically of the same size as the object or a little larger. Again, as no light is used in taking the photograph, there is no way at present of determining the proper exposure, the photometry of Roentgen rays being as yet unaccomplished.

Etymologically there is a chance for a new name—a photograph taken without light being an etymological absurdity.

From the point of view of pure science, it is impossible to predict what the result will be. We have a radiant force or energy which penetrates matter with varying degree of facility, yet which apparently cannot be refracted. We have something which may greatly modify our views of the action of the luminiferous ether, and which may help us eventually to a tangible theory of the great cosmic mystery—gravitation.

We especially desire to refer our reader to our SUPPLEMENT of the present week for Prof. Roentgen's original memoir on his great discovery, which we did not have space to publish in this issue. There will be found a succinct account of his investigations, set forth in form which should make his work a model for future investigators.

The Housemaid and the Dustpan.

To those who know the true inwardness of things the sight of a housemaid brushing a dusty carpet is suggestive of many evils. The death of Pasteur has reminded the world of what is constantly present in the thoughts of medical men—namely, that while micro-organisms are the great producers of disease, dust is the great carrier of micro-organisms. Now that we know these things, it is distressing to find how little our knowledge is put to practical use, and to see old customs still unchanged, old habits which we know to be destructive carried on, and to find the housemaid on her knees, with her brush and dustpan, stirring up dust to the detriment of everyone, and breathing germ-laden particles to her own destruction. It needs but a small amount of common sense to see that if carpets must continue, a thing greatly to be deprecated, they should be rubbed with a damp cloth rather than brushed, and that if, in deference to prejudice, they must be brushed, this should be done by a covered American sweeper with plenty of damp tea leaves. Of all ways of removing dirt from a carpet the worst is by the use of the ordinary short brush, which involves the housemaid kneeling down in the midst of the dust which she so needlessly creates, and drawing it into her lungs with every breath. For ordinary household use something like linoleum, something which can be washed with a wet cloth every morning, would seem to be the best covering for floors; but if carpets must be, and it is impossible to teach the present generation the evils of seeking present comfort at the expense of future risks, at least let us remember that carpets may be washed even where they lie; that, till the day of washing comes, a closed sweeper is far better than a brush, and that the worst form of brush is one with a short handle.—British Med. Journal.

A New Heavy Liquid.

A new heavy liquid has been discovered. Mr. S. L. Penfield describes its preparation in the December number of the American Journal of Science. Mix equal proportions of the nitrate of silver and thallium, and on heating the mixture it fuses at 75 degrees C., forming a clear mobile liquid of density 4·5, which mixes with water in all proportions. It can, therefore, be used to separate mineral particles of densities below 4·5. When still heavier particles have to be separated, the proportion of thallium may be increased. When the ratio is 3:4 the mixture fuses below 100 degrees C. and has a density of about 4·7. At 2:4 the fusing point becomes 150 degrees C. and the density 4 8; at 1:4 it is about 4·9 and fusion only takes place at 200 degrees. Finally, when pure thallium nitrate is used, the point of fusion is 250 degrees C. and the density closely approaches 5. This high range of densities, together with the fact that the salts do not attack many minerals, make the liquid especially valuable for mineralogical purposes. A convenient separator is described by the same author. It consists of a thimble-shaped cup, into which a wide tube is made to fit. The tube can be closed at the bottom by a hollow plug. This plug being removed, the heavy liquid is poured through the tube into the thimble, and the minerals are thrown in and stirred. The heavy particles sink into the thimble, and may be removed by closing the tube with the plug and withdrawing the thimble. The latter is then replaced, and the operation repeated with dilute liquid. With some practice an elaborate separation by densities is rapidly and easily accomplished.

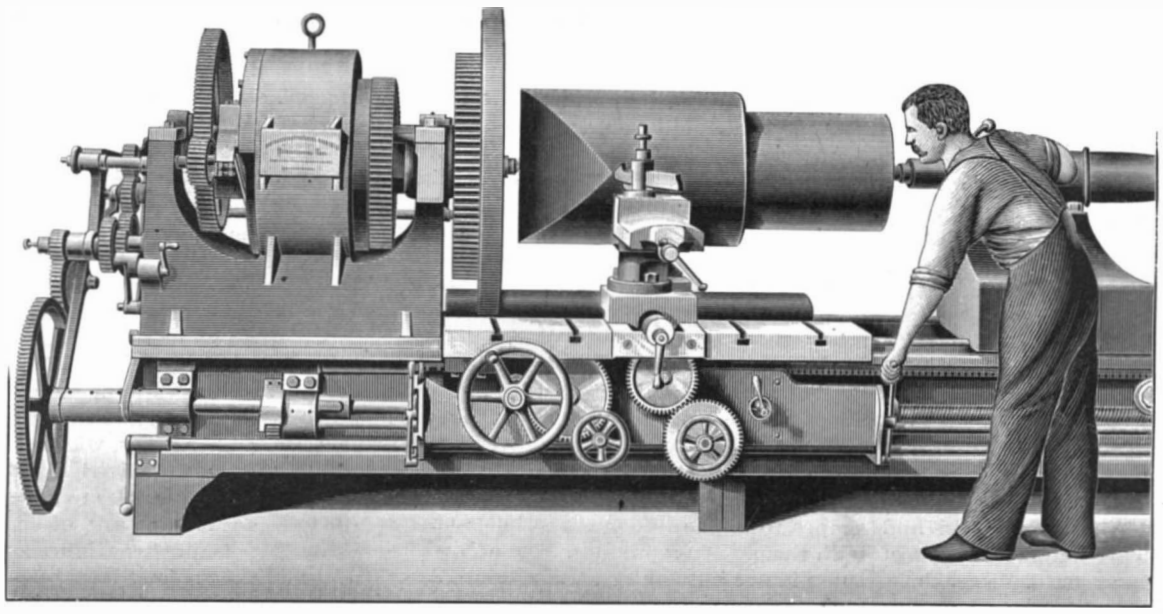
THE United States Consul-General at Bogota, in a recent report to the state department, expresses the belief that American merchants are not alive to their opportunities in South American markets. For instance, if a merchant of Bogota sends an order to an American manufacturer for goods cut to a certain length and width, the manufacturer writes back that he does not cut goods in those dimensions, and will not fill the order unless the goods can be taken as they are. For this reason the foreign trade in that part of the continent is being largely taken by German and British manufacturers, who are more accommodating in this respect.

TWO Sicilian scientists, says Popular Science News, Grassi and Rovelli, have recently discovered that the housefly is the intermediate host of a species of tape worm which does much harm among chickens. The chickens eat flies whose bodies contain the larvæ of the tape worm.

© 1896 SCIENTIFIC AMERICAN, INC.

A DIRECT-CONNECTED MOTOR AND LATHE.

The accompanying engraving, which is made from an illustration and description which appeared in the Mining and Scientific Press, of San Francisco, shows a novel application of the electric motor to shop work, in which the customary overhead shafting is completely done away with, and its place is taken by a motor which is built into the headstock of the lathe—in this case a 46 inch Niles Tool Works lathe. Apart from the economy which results from directly applied motive power, the removal of the overhead shafting and belting allows a much freer disposition of the various tools in a shop, for the reason that they do not have to be located with reference to their accessibility to the overhead traveling crane. The motor runs in either direction at nine different speeds, which vary between 57 and 275 revolutions per minute. The speed is controlled by a lever at each end of the apron of the carriage; and it is so conveniently placed to the operator that, without changing his position in front of the tool, he can at will either stop the lathe or change the motion instantly from any speed in one direction to any speed in the opposite direction. The operator has no belt to shift in changing speed, as in the ordinary lathe; and, consequently, in facing off work he can keep the tool at all times cutting up to speed, as it travels toward the center. In chasing threads, he can make a quick return by utilizing the high speed. In order to gain two speeds without shifting a belt, it is usual in turret lathes to provide mechanism for quickly throwing in or out some clutch or gears; but by means of the direct-connected motor the lathe can be instantly run at any one of nine speeds by the operation of the above-mentioned controlling levers.



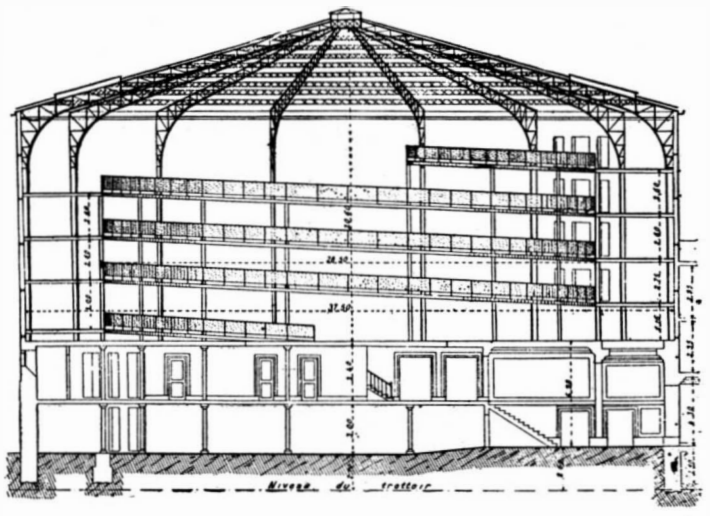
A DIRECT-CONNECTED MOTOR AND LATHE.

The motor is built by the Card Electric Motor and Dynamo Company.

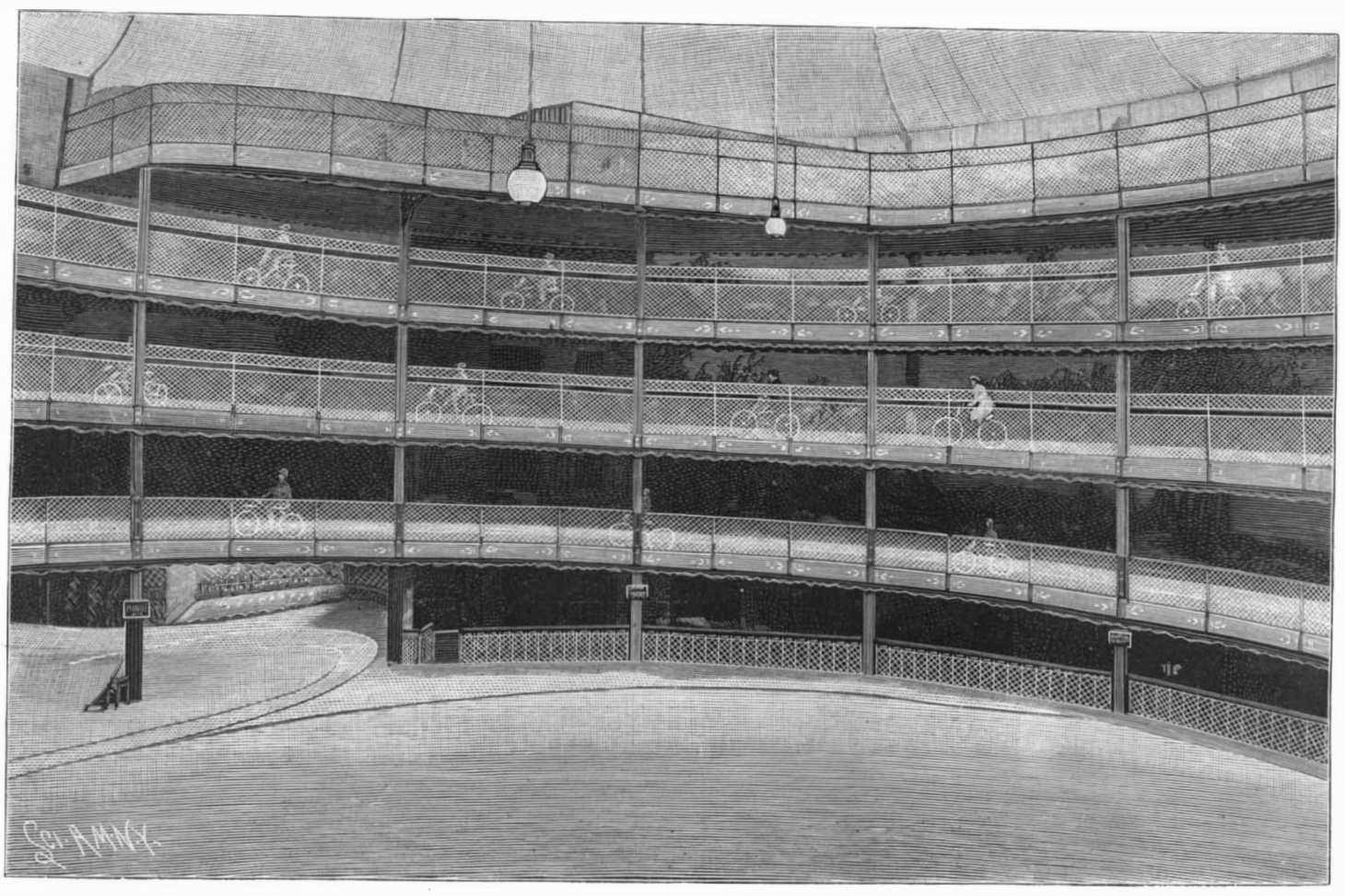
A COVERED SPIRAL BICYCLE PATHWAY IN PARIS.

With the enthusiasm and spirit characteristic of his race, the Frenchman has plunged into the sport of bicycling with an interest which almost casts into the shade our own devotion to this form of exercise. The bicycle is found everywhere in Paris, even in great numbers upon the most crowded thoroughfares. The Frenchman generally rides with great skill, and in the wheel he has found a friend particularly adapted to his restless nature. Men and women ride the somewhat willful tandem on the most crowded streets, and often at great speed, but, strange to say, accidents are less frequent than would be imagined. The winter months in Paris are naturally ill adapted to the sport, and the enthusiast is therefore driven under cover. Probably the greatest novelty in the way of a bicycle academy is the spiral path shown in the accompanying illustrations, for which we are indebted to the Genie Civil. This establishment is called the "Palais-Sport." The building was originally used for the military panoramas of the celebrated painters Detaille and De Neuville, representing the battles of Champigny and Rezonville. The projectors of the new establishment transformed the lower stories into various waiting, reading and dressing rooms, as well as private rooms where beginners can escape the eye of the curious. The various store rooms and repair rooms for the bicycles are also provided. The spiral pathway extends from the main floor of the academy to a point near the roof. The ascent is gradual, being about 2·5 to the 100, the total height being 36 feet. The pathway is divided into two paths by an inverted V-shaped board screen, the entire length of course, including the ascent and descent, being over a thousand yards.

The path is extended at the top into a spacious platform which enables the rider to make an easy turn before taking a long coast to the main floor below. A high screen protects the wheelman from being precipitated below in case of accident. A spacious room is reserved for spectators. The outer wall of the spiral is decorated somewhat elaborately with pastoral scenes, giving the effect of the country. The bicycles are brought to the main floor from the storage room by means of elevators.



DETAIL OF CONSTRUCTION OF THE PALAIS-SPORT.



A SPIRAL BICYCLE PATHWAY—PALAIS-SPORT IN PARIS.

Gas Engine Stations for Trunk Line Railways.

Mr. Westinghouse said in a recent speech that the strong argument heretofore used against the adoption of the electric system for main lines has been due to the fact that the investment required to make the change would be heavy, without materially decreasing the consumption of fuel and other costs of operation—an objection which it is believed can be met by the development and use of gas engines of large sizes instead of steam engines for the generation of the electric current. After presenting arguments to show that the gas engine would use but one-eighth the fuel of an ordinary locomotive to produce similar power, Mr. Westinghouse continued: "The Pennsylvania Railroad to-day, it is said, consumes about 5,000,000 tons of coal per annum on its lines east of Pittsburg, taking, approximately, 20 loaded trains each day for its transportation, and consequently the return of 20 empty trains, and requiring for the service of the company alone fully 3,000 cars and a proportionate number of locomotives. If this power were to be generated by gas engines, only about one-eighth, or 600,000 tons of coal per year, would be required, effecting a saving of over 4,000,000 tons of coal, now costing the railway company above $5,000,000—a saving which would justify a large enough capital expenditure to cover the complete equipment of the railway. To carry out an arrangement of this character, stations having electric generating plants with gas engines and producers could be located at intervals of from ten to twelve miles, so that there would always be two or three stations furnishing current for any particular part of the line."

Aluminum.

M. Henri Moissan has been investigating the contradictory results which experimenters have arrived at with reference to some of the properties of aluminum. M. Moissan ascribes these to the fact that all commercial samples of this metal contain impurities. The effects of nitrogen and carbon he has already dealt with, and having had occasion to analyze samples of aluminum from the works at La Praz (France), Neuhausen (Switzerland), and Pittsburg (United States), he has now discovered a new impurity—namely, sodium. This may be present to the extent of from 0·1 to 0·3 per cent, and renders the aluminum liable to be slowly attacked by water. The presence of a small quantity of sodium also completely alters the character of aluminum alloys.

THE Microscope gives this formula for an ink for writing on glass with a pen, as with ordinary ink: Bleached shellac 10 parts, Venice turpentine 5 parts, lampblack 5 parts. Dissolve the shellac with turpentine and stir in lampblack.

© 1896 SCIENTIFIC AMERICAN, INC.

SOME AMERICAN MOTOR CARRIAGES.

This is an age in which it is not safe to deride any forecast in mechanics, so that the prophecy, now often made, that in the near future the clatter of the horse's hoof shall no longer be heard on the fashionable driveways, and that the noiseless bicycle and the pneumatic tired wheels of the motor carriage shall reign supreme, while undoubtedly exaggerated, still holds true to a certain extent.

In the early part of the century there was a period of development of steam carriages, but at that time there were no such favorable conditions for success as those which surround the experimenters of to-day, as the roads were bad and only steam was available as a motive power. But since that time not only has road making been reduced to a science, but the cumbersome motor wagon and engine has given place to the steel framed pneumatic tired vehicle, and various forms of light motors have been devised, actuated by one of the many products of petroleum or by steam, gas or electricity.

In 1894 a great impetus was given to the automobile carriage by a competition organized in Paris by the Petit Journal. The course was from Paris to Rouen, 75 miles, and the prizes amounted to 10,000 francs. Fifteen competitors took part in the race, which occurred in July. The best time made was 5 hours 40 minutes. The gasolene motors, as usual, made the best showing in the contest. On June 11, 1895, occurred another race in France, for prizes aggregating 40,000 francs. The course was from Paris to Bordeaux and return, a distance of 727 miles. Sixty-six horseless vehicles competed, and the best time was made by a petroleum carriage, which made the entire journey in 2 days and 53 minutes, or at the rate of 14 9-10 miles an hour. With a laudable attempt to awake widespread interest in the motor vehicle in this country, the Chicago Times-Herald offered prizes last July aggregating $5,000. We have already published full particulars of this contest, which occurred at an unfortunate time of the year as regards the weather, so that the results obtained were not as valuable as they would have been had the race occurred earlier in the season.

It is gratifying to note that there will also be a race in this country in May. The Cosmopolitan Magazine offers $3,000 in premiums to be awarded to motor carriages presenting the greatest number of points of excellence as exhibited in a trial trip to be made from the New York office of the Cosmopolitan, City Hall Park, on Saturday, May 30 (Decoration Day), 1896, to the Cosmopolitan building at Irvington, and thence back to the starting point.

The award will be made upon the following points, the maximum being 100; speed, 50; simplicity and durability of construction, 25; ease in operating and safety, 15; cost, 10. Entries must be sent to the office of the Cosmopolitan before May 1. The names of the judges will be announced in the March issue of the Cosmopolitan.

AMES' STEAM CARRIAGE.

MORRIS & SALOM'S CRAWFORD WAGON.

We present illustrations of four American built motor carriages, some of which have been very successful. Mr. Harold Sturges, of the Sturges Electric Motocycle Company, has devoted attention to the electric motor vehicle for some three years, and he had a carriage on exhibition at the World's Fair. The carriage which we illustrate was originally a three seated sulky for six persons, weighing 2,750 pounds in running order, but the third seat was removed, so as to give increased space for the batteries, and the wheels, which were formerly provided with steel tires, are now provided with solid rubber tires. A new motor of the Lundell type has been placed in it. We understand that the manufacturer is now engaged in constructing a new carriage. The vehicle shown in the engraving has four wheels, the front wheels being 3½ ft. and the rear wheels 4 ft. in diameter. In the body are thirty-six storage battery cells, with a capacity of 250 ampere hours. These batteries actuate a three horse power motor and the power is transmitted to the axle by single reduction gears. The carriage has a speed of three to ten miles per hour on good roads, and the storage batteries enable it to travel about seventy miles on a hard level road without recharging. In the Chicago Times-Herald race, the condition of the roads was such that the wheels of the Sturges carriage slipped very badly in the six inches of snow, and nearly double the usual power was exerted, so that the carriage traveled with the speed of only 4¼ miles per hour, the batteries becoming exhausted after a run of thirteen miles. The Sturges machine received an award of $500 for the showing made in the road race.

Although the Morris & Salom "Electrobat" did not attempt to run over any gre.. part of the course of the Chicago Times-Herald race on last Thanksgiving Day, it was still awarded the great gold medal by the judges for pre-eminence, because of the following points of merit. The award of the judges states that the medal was given "for best showing the official test for safety, ease of control,

HERTEL'S GASOLINE CARRIAGE.

STURGES' ELECTRIC MOTOR WAGON.

© 1896 SCIENTIFIC AMERICAN, INC.

absence of noise, vibration, heat or odor, cleanliness and excellence of design and workmanship." The carriage which took part in the race presents a handsome appearance, and at first sight it resembles some new kind of surrey. As no machinery is in sight, with the exception of the steering lever, this motor carriage is free from the criticism which is generally passed on horseless carriages, that they look more like a box of machinery than a pleasure vehicle. The other carriage, which is shown in the engraving, seats two, and is what is known as a "Crawford wagon." The wheels of the prize winner are of wood, and are of the usual construction, except that they are fitted with pneumatic tires and ball bearings. The driving or front wheels are 40 inches in diameter, and the rear or steering wheels are 38 inches in diameter. The steering is accomplished by turning the rear wheels parallel with each other from a point about three inches inside of the plane of the wheel, and they are connected by a rod to a vertical lever at convenient height, which is operated from the front seat of the carriage. Although at first sight it might be supposed that steering from the rear might be more difficult than steering from the front, yet, as a matter of fact, it is found not to be the case, as the carriage can be moved in any direction desired with great certainty and can be completely turned around in a circle of 20 feet in diameter. The batteries are furnished by the Electric Storage Battery Company, Philadelphia, Pa., and consist of four sets of twelve cells each, having a normal capacity of 50 ampere hours per cell. They are grouped in boxes and so arranged that they can be readily and quickly pushed in place inside the body of the carriage, all of the connections being made automatically. The carriage is driven by two Lundell motors of nominal one and one-half horse power capacity. Each is attached to the front axle with pinions on the armature shafts, gearing directly into the driving gears attached to the front wheels. The weight complete with the batteries is 1,650 pounds. It is said that on good roads a maximum speed of twenty miles per hour can be obtained. The capacity of the battery is sufficient to run the carriage from twenty-five to thirty miles on one charge. The carriage shown in the engraving is of lighter build.

By far the lightest motocycle among those which were present at the contest of November last was the gasoline carriage of Max Hertel, of 103 West Monroe Street, Chicago, Ill., as the motocycle weighs only 220 pounds and seats two people. Although this carriage did not take part in the race, it was awarded a prize by the judges of the Times-Herald motocycle race of $100 for a device for starting the motor from the operator's seat in the vehicle.

The vehicle is built on the lines of the bicycle, the frame being constructed of seamless steel tubing and the wheels have tangent spokes, ball bearings and pneumatic tires. The carriage is driven by a double cylinder gasolene motor of special construction, which weighs only 100 pounds and which develops two horse power at full speed. The power from the motor is transmitted to the rear wheels by means of friction gearing, which does away with all belting, chains, and sprocket wheels and insures an easy and almost noiseless running vehicle. The motocycle is guided and controlled with the aid of two levers. One lever stops and starts the motor, connecting it with the vehicle and disconnecting it, changes the speed and gear and sets the brakes, all with a simple forward and backward motion. The other lever is used to steer the carriage. The reservoir holds enough gasoline for a fifty mile run, and the cost amounts to less than one cent for each five miles traversed on a level road.

The Ames steam carriage was devised by Mr. A. C. Ames, of Chicago. The boiler is of the Scotch type, the heat from the burners passes under the shell of the boiler and passes out by forced draught with the exhaust. The fuel used is gasolene, and the burners are so arranged that one is controlled by the operator, while the other is controlled by the steam pressure or by hand as desired. When the carriage is stopped, the steam pressure rises rapidly and cuts down the flame of the burners, and when the pressure drops the supply of gasolene is again increased. The feed water passes through a heater inside the boiler jacket. The engines are fastened on the lower part of the bicycle frame and are coupled to the treadle shafts by means of crank pins. The engines are of the oscillating type and the diameter of the cylinder is 1¾ in., stroke 13 in. The trunnions are of cast iron. The weight of the entire vehicle when ready for a run is only about 400 pounds.

An Industrial Exposition in Brazil.

An exposition representative of the industries of Brazil is now in progress at the capital, Rio Janeiro. It is said to afford proofs of material progress in manufactures, particularly in the growth of small industries in the different provinces. The Rio News says: "It will be a revelation to many to find that there are so many industrial establishments in the country."

Artificial Monstrosities.

Prof. J. A. Ryder, of Philadelphia, says Dr. Eugene Murray-Aaron in Popular Science News, has recently made research of some length into the methods by which the Japanese have produced the race of double-tailed gold fish, Carassius auratus, which are such favorites with fanciers and the owners of aquaria in this country; and, incidentally, he has also called attention to some very interesting facts of a like nature regarding other allied vertebrates. The experiments of Weber, proving that the eggs of the common pike could be caused to produce double monstrosities if the recently fertilized eggs were violently shaken, were the initial discoveries that have led to the present doubling from a single yolk. This fact is known to our fish commissions, and great care must at first be used to prevent the almost entire production of monstrosities by rough handling.

More remarkable still is the conclusion reached by Von Ihering that certain armadilloes normally produce several young from a single fertilized egg. Dr. Ryder is inclined to regard the double-tailed gold fish as "the actual realization of an eight-limbed vertebrate," a thing most contradictory of our present basis of animal classification. These fish have been produced in Japan, he concludes, for at least two centuries, and they there command high prices among the wealthy classes, the finest or most abnormal variations being in great demand. By taking the eggs of the normal species of gold fish and shaking them, or disturbing them in some way, the Japanese get double monsters, some with double heads and a single tail, and some with double tails. Naturally the complete double monsters would be unlikely to live, while those with only the duplication of the tail, having the problem of life in no way complicated for them, would be quite likely to survive. These monstrosities, being selected and bred, would in all probability hand onward the tendency to reproduce the double tail, which in time would become fixed and characteristic, if judicious selection were maintained by interested breeders, as has been the case with the many breeds of dogs, horses, fowls and pigeons.

Barfurth, experimenting upon tadpoles, has found that duplication of the tail in them has much to do with the manner in which it is removed. For example, if the tip of the tail were snipped off exactly at right angles to the axis of the body, the tail was regenerated of the normal form and straight backward. If removed at an acute angle, regeneration took place, so that the new tip was directed either upward or downward, according as the inclined, regenerated cut surface looked upward or downward. These facts cannot be dismissed as useless in connection with the problem of inheritance in general; for while, as we rise in the scale of organization, the tendency to regenerate lost parts becomes more restricted, the tendency to produce monstrosities due to disturbances of development remains in full force, as is illustrated by the disposition to reproduce extra toes in the cat, the same tendency hereditary in the Dorking fowl, or even the disposition to reproduce extra thumbs or toes in the human family.

Timber Supports.

The American Association of Railway Superintendents, Bridges and Buildings, says the Architect and Contract Reporter, recently appointed a committee for the purpose of considering the strength of bridge and trestle timbers. The committee came to the following conclusions:

1. Of all structural materials used for bridges and trestles, timber is the most variable as to the properties and strength of different pieces classed as belonging to the same species, hence impossible to establish close and reliable limits of strength for each species.

2. The various names applied to one and the same species in different parts of the country lead to great confusion in classifying or applying results of tests.

3. Variations in strength are generally directly proportional to the density or weight of timber.

4. As a rule, a reduction of moisture is accompanied by an increase in strength; in other words, seasoned lumber is stronger than green lumber.

5. Structures should be, in general, designed for the strength of green or moderately seasoned lumber of average quality, and not for a high grade of well seasoned material.

6. Age or use does not destroy the strength of timber, unless decay or season checking takes place.

7. Timber, unlike materials of a more homogeneous nature, as iron and steel, has no well defined limit of elasticity. As a rule, it can be strained very near to the breaking point without serious injury, which accounts for the continuous use of many timber structures with the material strained far beyond the usually accepted safe limits. On the other hand, sudden and frequently inexplicable failures of individual sticks at very low limits are liable to occur.

8. Knots, even when sound and tight, are one of the most objectionable features of timber, both for beams and struts. The full size tests of every experimenter have demonstrated not only that beams break at knots, but that invariably timber struts will fail at a knot, or owing to the proximity of a knot, by reducing the effective area of the stick and causing curly and cross grained fibers, thus exploding the old practical view that sound and tight knots are not detrimental to timber in compression.

9. Excepting in top logs of a tree or very small and young timber, the heart wood is, as a rule, not as strong as the material further away from the heart. This becomes more generally apparent in practice in large sticks with considerable heart wood cut from old trees in which the heart has begun to decay or been wind shaken. Beams cut from such material frequently season check along middle of beam and fail by longitudinal shearing.

10. Top logs are not as strong as butt logs, provided the latter have sound timber.

11. The results of compression tests are more uniform and vary less for one species of timber than any other kind of test; hence, if only one kind of test can be made, it would seem that a compressive test will furnish the most reliable comparative results.

12. Long timber columns generally fail by lateral deflection or "buckling" when the length exceeds the least cross sectional dimension of the stick by 20; in other words, the column is longer than 20 diameters. In practice the unit stress for all columns over 15 diameters should be reduced in accordance with the various rules and formulas established for long columns.

13. Uneven end bearings and eccentric loading of columns produce more serious disturbances than usually assumed.

14. The tests of full size long compound columns composed of several sticks bolted and fastened together at intervals show essentially the same ultimate unit resistance for the compound column as each component stick would have if considered as a column by itself.

15. More attention should be given in practice to the proper proportioning of bearing areas; in other words, the compressive bearing resistance of timber with and across grain, especially the latter, owing to the tendency of an excessive crushing stress across grain to indent the timber, thereby destroying the fiber and increasing the liability to speedy decay, especially when exposed to the weather and the continual working produced by moving loads.

Prize Offered for a Fuse Design.

The Verband Deutscher Elektrotechniker is offering a prize, consisting of a diploma and $75, for the best device by which mistakes, such as placing the wrong size fuse in fuse terminals, and the interchanging of fuses except by authorized persons, shall be rendered impossible. The standard sizes of lead fuses adopted by the Verband at its last annual meeting are to be employed. These, according to the Electrical Engineer, are:

Amperes.	Distance between centers of fuse terminals in inches.	Diameter of terminal screw in inch.
50	2·8	¼
100	3·2	5/16
400	3·8	½
1,000	4·4	¾

The designs are to remain in every respect the property of the individual, and must be sent in not later than April 1, 1896, addressed to the Verband at 3 Monbijouplatz, Berlin, N., and marked with a motto. The result will be made public at the next annual meeting of the Verband.

Blast Furnace Charges as Lightning Conductors.

Repeated instances are said to have been noted in Germany of lightning flashes, instead of being attracted by the lightning conductor on a blast furnace chimney, taking the charge of the chimney itself as a conductor, and passing down through the furnace charge, through the pig bed and into the earth, without doing any damage. It is said that this has occurred several times at one furnace, where a good conductor extends above the top of the chimney, the explanation being that a column of smoke containing much water and carbon dust extended up to a considerable height, and thus furnished a better conductor of electricity to and through the charge itself than was afforded by the outside conductor.

His Collar Exploded.

William Benjamin, a brakeman on the Erie Railroad, caught a spark on the back of his celluloid collar as his train entered the station at Hillsdale, N. J., January 2. The collar took fire and exploded with a loud report. Benjamin seized the collar with both hands and tore it from his neck. He was burned severely on the face, neck and hands. He was taken to a drug store, where his wounds were dressed, and later was taken to his home in New York. He will be disabled for some time.

© 1896 SCIENTIFIC AMERICAN, INC.

WILLIAM CROOKES, F.R.S.

The recent remarkable discoveries of Prof. Roentgen when engaged in experimental work with a Crookes tube have brought prominently before the world the name of William Crookes, a name that was already famous in the world of science. There are, indeed, few, if any, among the scientific leaders of the latter half of the nineteenth century who have had a more brilliant and varied career than the author of the vacuum tubes which have made possible the recent startling developments in photography.

He was born in London in 1832, and at an early age turned his attention to photography. After a course at the Royal College of Chemistry under Dr. Hoffman, during which, at the age of 17, he gained the Ashburton scholarship, he became in due time senior assistant to his tutor. His rise was rapid, and at the age of 22 he was appointed superintendent of the meteorological department of the Radcliffe Observatory at Oxford. In 1859 he founded the Chemical News, and five years later he became editor of the Quarterly Journal of Science.

Prof. Crookes had a natural love for original research. In 1861, while examining the residues from a sulphuric acid works, he discovered the new metallic element thallium. This was followed by his election as a fellow of the Royal Society. It was his "delicate spectroscopic investigations" in connection with the newly discovered element "which led him to the study of the 'rare earths,' which has proved so fruitful in his hands."

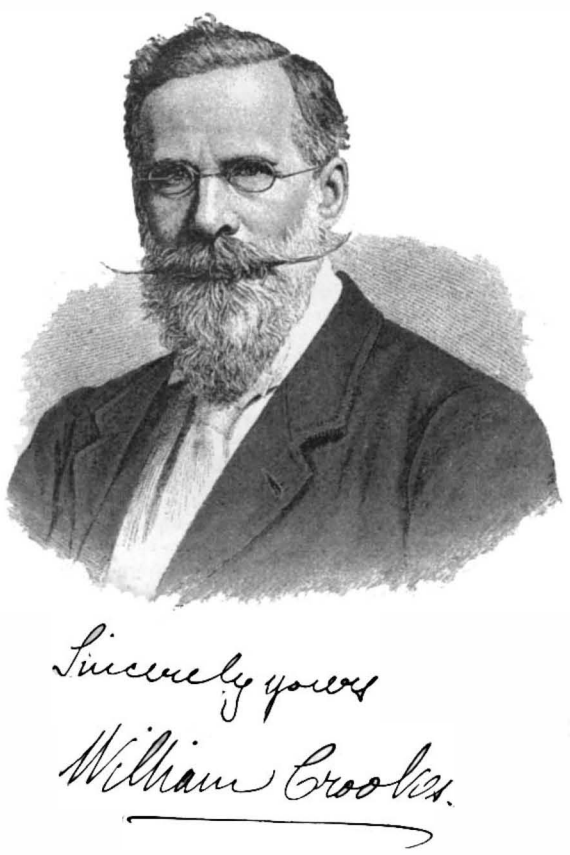
The mining world is deeply indebted to him for drawing attention to the value of sodium amalgam in the extraction of gold. At a later date he called in the aid of the alternating electric current. This agent, acting in concert with various mercurial salts, and particularly with mercury cyanide, has rendered possible the extraction of gold from highly refractory ores.

In 1872 he was at work on his investigations on "Repulsion Resulting from Radiation," to which question his attention had been drawn by his observing the action of heavy pieces of glass which he was weighing in a vacuum balance, which, by the way, was his own invention. In 1877 he invented the otheoscope; and in the same year Science signified its indebtedness to him by electing him a member of the Royal Society. In a paper before the society he stated that he had "succeeded in obtaining a vacuum so nearly approaching perfection that the pressure in it was only 0·4 millionth of an atmosphere." These experiments led to very important results; for it was found that in such an extreme vacuum gases pass into an ultra-gaseous state, which Prof. Crookes termed a state of "radiant matter;" and further, these extreme vaccua opened up the way for the incandescent lamp.

A March number of the Electrician of 1891 says: "Professor Crookes' house in Kensington Park Gardens, electrically lighted in 1881, was, we believe, the first house in London fitted up with the electric light. It may be interesting to state that the wires were chiefly laid with his own hands. To meet the difficulty of obtaining carbon filaments for the glow lamps, not possessing the structure of the material from which they were made, Prof. Crookes dissolved cellulose in a strong solution of ammonium copper sulphate, dried up the solution into sheets, dissolved out the copper, and used the hornlike material remaining for filaments. The lamps in the inventor's house, fitted with such filaments, remain still in good working condition."

In 1880, the French Academy of Sciences conferred upon Prof. Crookes an extraordinary prize of 3,000 francs and a gold medal, in appreciation of his researches in molecular physics and on radiant matter.

His studies of the "rare earths" have led Prof. Crookes to the conclusion that "the bodies which have generally been accepted as elements are not primordially distinct or independent, but have been formed by a process of evolution remotely analogous to that which we now recognize as having been at work in the formation of organic species." These views were put forth in his presidential address before the chemical section of the British Association, under the title "The Genesis of Elements;" and it is undoubtedly his most splendid among many brilliant contributions to the philosophy of science. In 1885 the Society of Arts, and in 1888 the Royal Society, gave him medals, the first "for his improvement in apparatus for the production of high vacua and for his invention of the radiometer," and the latter society "for his investigations on the behavior of substances under the influence of the electric discharge in a high vacuum."



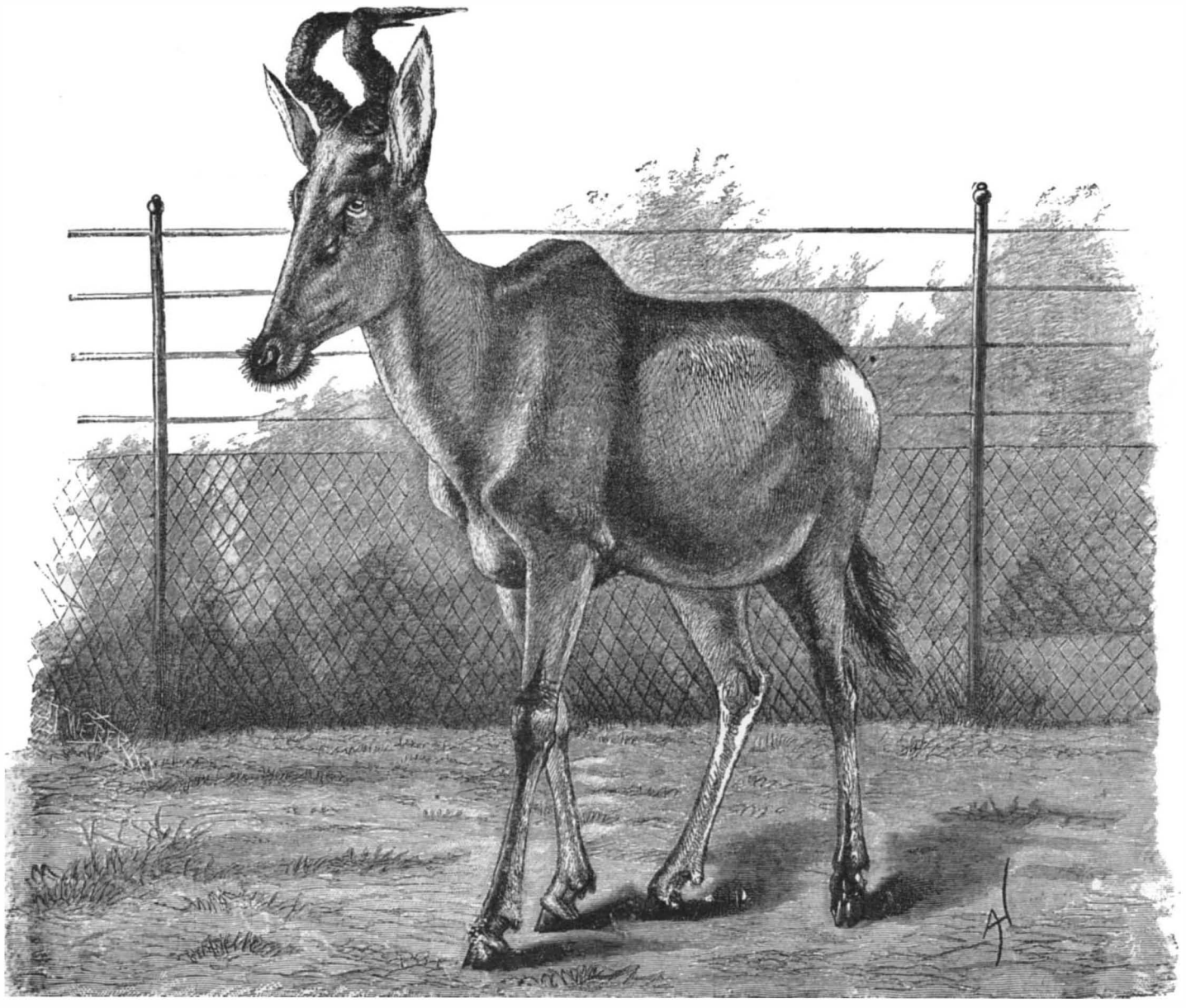
In addition to his extensive work in the laboratory, Prof. Crookes has been a voluminous contributor to the scientific literature of the age. Among other works he has written "A Handbook of Dyeing and Calico Printing," "Select Methods in Chemical Analysis," a manual of "Dyeing and Tissue Printing," a work on "The Solution of the Sewage Question." He has translated and edited Reimann's "Aniline and its Derivatives," Wagner's great work on "Chemical Technology," and many other works of scientific prominence have emanated from his busy pen.

The splendid results which have attended Prof. Crookes' labors are not to be attributed solely to his undoubted genius for experiment and observation. They are largely the result of persistent hard work carried out on logical lines and with strict attention to method. He possesses that "infinite capacity for taking pains" which is indispensable to genius, if its powers are to produce valuable, lasting results.

A COMPANY is being formed, it is announced, to work a coalfield at Astley, in Warwickshire, where, it is stated, the principal seams are over 20 feet in thickness, and are not deeper than 500 yards. The English Mechanic thinks it rather strange that a field so rich and so near London has not been worked before.

THE KONZI ANTELOPE IN THE BERLIN ZOOLOGICAL GARDEN.

For many years past antelopes of certain species have been a familiar sight in the zoological gardens, but explorers knew that there were many other species on the steppes of Eastern Africa that had never been exported. One of the most interesting of these is the konzi antelope, only one living specimen of which has been taken to Europe, and that is now in the Berlin Zoological Garden. Our engraving (for which we are indebted to the Illustrirte Zeitung) is taken from a drawing of this animal made by Anna Held. These antelopes graze in small herds on the grass-covered steppes while an old bull keeps watch from a neighboring eminence. They prefer places where fresh, new grass has started after the old grass has been burned over, but a short time spent in such a locality makes quite a change in their appearance. They are naturally of a golden brown color, so near the color of the ground on which they graze that it is difficult to distinguish them from a distance, but after grazing in one of these burned districts they have black spots on their shoulders that might easily lead a naturalist to suppose they belonged to a different species from those that had grazed where there had been no fire. These spots are caused by rubbing their shoulders against charred trees, the black being retained by the oily secretion of the lachrymal glands. The only natural black marks are those on the legs.



THE KONZI ANTELOPE.

DECEMBER fires in the United States and Canada caused a loss of about $10,000,000, and the milling and allied industries contributed about $410,000. The total loss for 1895 is $130,000,000, against $128,000,000 in 1894 and $157,000,000 in 1893.

© 1896 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

Engineering.

STEAM ENGINE.—William F. and Eugene W. Cleveland, Rounthwaite, Canada. To prevent all possible back pressure, by affording a full and complete exhaust, thus utilizing the steam to its utmost efficiency, these inventors provide a hollow piston connected at all times with the exhaust, while valves mounted on the heads or faces of the piston alternately connect its interior with the ends of the cylinder.

Railway Appliances.

CAR FENDER — Michael F. Flynn, Stamford, Conn. This fender is normally carried in substantially vertical position in front of the dash board, but has a lower front cushioned roller adapted to strike and trip one caught in the path of a moving car, in which case the lower portion of the fender is automatically moved out to present a bed to receive the falling body. Simultaneously with this action a cable attached to the brake and another connected with the trolley arm are operated to apply the brakes and break the electric connection supplying power, or to release the grip in case the car is moved by cable.

AUTOMATIC REPEATING SIGNAL.—Robert H. Innes, San Antonio, Texas. This is an apparatus for use in connection with semaphore and other train signals to prevent mistakes when notifying the central official, and automatically report changes in the position or color of the signal to a central office over the ordinary telegraph wire. A wheel operates a key to send a message that the signal is changed to "danger," and the turning of the wheel engages the signal repeating device, so that when the latter is actuated to clear the signal a second message is sent to the central office to that effect.

Electrical.

ELECTRIC RAILWAY SYSTEM.—John F. Page, Chewacla, Ala. This is an improvement in systems where the main line conductor is underground, and has feeders, each consisting of a normally open partial circuit leading to a contact rail or plate, and having a circuit closing device. An endless driven cable carried on the car is arranged to contact with the contact rails or plates in the conduit, transmitting the current through the cable to the motor circuit, and improvements are introduced in the circuit closing devices to be actuated by the endless cable, the improved system being designed to be more safe and efficient than systems heretofore in use.

Mechanical.

TONGS.—John Quinn and William H. Bradley, Mingo Junction, Ohio. These tongs may be readily opened and closed or moved about, a uniform power being obtained for their opening and closing, while they securely hold or release the article. On one of the tong arms is a rock bar engaging a pinion on the other tong arm, there being a rein or handle for turning the pinion.

METALLIC PACKING.—Edward L. Raynsford, Susquehanna, Pa. This is an improvement on a formerly patented invention of the same inventor, providing a packing for use on piston rods, balance slide valves, etc., without the use of springs or glands, and consisting principally of a ring having an annular groove with outwardly beveled sides and a second ring with inwardly beveled sides fitting in the groove of the first ring. For balance slide valves the packing is made in straight form.

Miscellaneous.

BICYCLE SUNSHADE. — John Murgatroyd, New York City. By means of clips this sunshade may be connected to the frame of a bicycle and adjusted at any inclination desired, and there are mounted at the upper end of the staff ribs and braces of peculiar construction, whereby the forward ribs may be shortened and the rear ribs lengthened, to afford a shade with rearward extension that will offer but little resistance to the wind, the cloth being effectively prevented from tearing by the operation of the bows and braces.

BLOOMERS.—Thomas H. Royce, Brooklyn, N. Y. This invention is for a garment formed of two duplicate patterns or cuts designed to produce a graceful fullness at the lower portion of the bloomers, and cause them to appear as nearly like a skirt as possible.

RACE TRACK STARTER'S GATE.—Patrick Ryan, New York City. For stopping the horses where a false start has been made for a race, this invention provides, near the head of the race track, a pliable gate having hanger arms pivoted on posts, springs pressing the arms and gate normally upward, and a latching device holding the gate down, while a releasing mechanism may be operated by the starter. When the horses have made a good start, the starter shifts a lever which releases the gate, when it rises to clear the track, but the gate is allowed to remain down when a false start has been made

DUPLICATE WHIST BOARD. — Lucius C. Thompson, Rolfe, Pa. This invention provides means for attaching counters to the board, and also for holding cards in place on the board, the latter being so made that auxiliary counters may be placed on it without confusing the regular counters. The corners at opposite sides of the board are of different arrangement, to provide for a proper location of the board in original and duplicate.

MUSIC LEAF TURNER.—Peter H. Adams, Osorno, Chile. This device comprises a casing in which revolves a cylinder having projecting pins adapted to engage levers, the latter engaging a second series of spring actuated levers or arms whereby the leaves of sheet music may be successively turned, the casing being placed upon a piano with the leaves of music engaged by the arms, when each leaf is turned as the performer strikes a lever at one side.

PHOTOGRAPHER'S DARK ROOM.—Ferdinand A. Wattenberg, New York City. This is a portable apparatus, which may be readily folded up for transportation or storage, and when opened out and set up enables the user to develop sensitive plates, and fill holders and cameras, etc. It is made of flexible material to inclose the upper part of the body in one end, while in the end piece at the other end is a ruby glass window, and the bottom is formed with pipes or tubes which permit the entrance of air.

LAMP. — Jacob Weintraub, New York City. This invention relates especially to alcohol lamps, for which a cap or cover is provided to increase, diminish or extinguish the flame, the cap being operated from the exterior of the lamp. The horizontal combustion surface has a ring-shaped cover, the opening of which is regulated by segmental plates having pivotal connection at one end with the cover, in which is supported a ring having radial slots into which projections from the plates extend, there being on the ring a rack engaged by a pinion whose shaft extends outwardly and terminates in a hand wheel.

WATER COOLER AND FILTER.—Henry Roeske, Philadelphia, Pa. With this apparatus filtered water may be drawn directly from the water supply pipes or from the cooler, as desired, and the filtering material is designed to be impregnated with a mineral salt, as borax, or with salicylic acid, to temporarily prevent or arrest fermentation of impurities not removed by mechanical filtration. The filter occupies the bottom portion of a cylindrical tank in which is an ice surrounded receiving vessel connected with the water supply, the overflow of this vessel passing down through a central tube to the filter bed, while the water supply is also directly connected by another pipe with the central tube.

FENCE WIRE FASTENER.—Reuben E. Curtice, Spencer, Ohio. In wire fences where the wires are kept parallel by upright stay rods, this improvement provides readily applicable novel spring clasps to retain the stay rods in position, and permit their ready removal when desired. The clasp consists of a wire bent upon itself to form a loop and two parallel members, both of which are bent to form U-shaped loops, both the stay rods and the wire being embraced by the loops.

WIRE FENCE MACHINE. — Zachariah R. Kling, Laclede, Mo. Where wire fences are made up of palings or pickets and posts, the wires being attached to the posts and looped around the palings, this improvement provides a simple device whereby two or more wires may be readily twisted to hold between them a paling, the wires being at the same time stretched, and the stretching device being temporarily attached to the post over which the wires may be drawn. The wires are held parallel and taut by a clamping mechanism, some distance in advance of a twisting mechanism, through which the wires pass, being twisted by the turning of a crank as each picket is placed in position.

ROAD RAKE.—Albert Daggett, Strong, Me. This improvement comprises a vehicle from which is suspended a V-shaped rake, with its point forward, a lever mechanism being adapted to raise either side of the rake independently, and springs being arranged to press against the upper surface of the rake back. It is a simple machine for use on country or unpaved roads, being adapted to sweep away all loose stones, etc., without disturbing the roadbed or gravel, while also leveling the road by breaking up dried mud.

REIN HOLDER.—Granville Bartlett, Rushville, Ind. This holder is formed of wire, with side lengths adjusted on opposite sides of the dashboard, the wire having finger-hold loops and crimped holding portions, having a strong downward tension. By means of the finger holds the holder may be lifted to pass the reins between it and the dashboard, where they will be held by the tension of the holder.

SPOKE SOCKET.—Samuel S. Sheaffer, Veedersburg, Ind. An improved spoke adjuster and clip, by means of which the tires of a wheel can be readily and quickly tightened, is provided by this invention, comprising a socket to fit on the spoke, there being in the upper end of the socket a bolt having a conical upper end, while a clip fitting upon the felly has a socket to receive the conical end of the bolt. The device may be readily applied to old wheels whose tires have become loose as well as to new ones.

CHEESE CUTTER.—Nicholls J. Smith, Waycross, Ga. This is a simple mechanism by means of which cheese may be cut into slices of any desired weight, an indicator plate marking the width of cut necessary for a slice of the weight sought. The cheese is supported upon a revolving table, and a center rod projecting upward through the cheese forms a guide for the rear end of a vertically moving knife or cutter actuated by a rack bar by rotating a hand shaft. A graduated gage plate is adjustably supported above the cheese from a collar clamped to the center rod.

BOTTLE FILLING DEVICE.—James Iredale, Toronto, Canada. This is a simple and inexpensive device designed to be directly applied to a can or other receptacle, and having branching tubes each connecting with a single bottle, a valve opening or closing all the tubes simultaneously. In connection with the filling device, a tray is arranged to hold the bottles stationary when beneath the filling tubes.

COLLAR BUTTON.—Ferdinand A. Wattenberg, New York City. This button has the usual base, shank and head, but in the front of the head is a recess and an upwardly opening spring pressed hinged plate, on the back of which are prongs, which project downward when the plate is opened and swung up. The plate is closed when the button is placed in the neck band and the collar buttoned over it, but before tying the scarf the plate is swung upward, when its prongs hold the tie in position and prevent it from slipping upward or sidewise.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

THE INTELLECTUAL RISE IN ELECTRICITY. A History. By Park Benjamin, Ph.D., LL.B. New York: D. Appleton & Company. 1895. Pp. xi, 611. Price $4.

Dr. Benjamin's work on the early history of electricity contains, naturally, a quantity of interesting matter. It deals with the work of the early philosophers. Of course, the exact status of intellectual progress in the olden times is very difficult to get at, it being certain that, in our inability to get below the surface, we often misjudge the motives which actuated the people of past centuries. In Dr. Benjamin's book considerable readiness to criticise unfavorably these people of the past is shown, and the work cannot, we think, be accepted as a reliable exponent of the real intellectual life of the ages of which it treats, it being questionable if data enough exist for obtaining a true idea of those days. In other words, Dr. Benjamin's views seem to us to be decidedly one-sided, and he never hesitates to give his personal view of matters hardly appertaining to science.

LECTURE NOTES ON THEORETICAL CHEMISTRY. By Ferdinand G. Wiechmann. Second edition. New York: John Wiley & Sons. London: Chapman & Hall, Limited. 1895. Pp. xviii, 283. Price $2.50.

Dr. Wiechmann's work, now before us, attempts to review to an adequate extent the subjects of chemical physics, stoichiometry and chemical energy, thus giving a philosophical view of the entire theory on which modern chemistry is based, not touching upon chemistry pure and simple as such. The advanced chemist will find in it much to interest him, notably in the treatises on chemical notation and on the molecular theory. An excellent index of subjects, with a supplementary index of names and an adequate table of contents, are features of the book which still further commend it to us. It will be found an excellent work to remove from chemistry the dry aspect of a mere collection of facts, as it systematizes and puts the whole into concrete form.

THE ELECTRICAL TRANSMISSION OF ENERGY. A Manual for the Design of Electrical Circuits. By Arthur Vaughan Abbott, C.E. With nine folding plates. New York: D. Van Nostrand Company. London: Sampson Low, Marston & Company, Limited. 1895. Pp. xiv, 586. Price $4.50.

There is no question that the transmission of energy is now one of the most important functions of electricity. This excellent work, liberally illustrated, with excellent table of contents, list of plates and satisfactory index, is to be strongly commended as a valuable addition to technical literature in the larger field of electrical engineering. Its very numerous illustrations and diagrams alone almost suffice to tell its story, and we are glad to be able to commend it to the electric profession. It seems thoroughly up to date, something which it is very difficult to obtain in a work on electricity, but this one really seems adequate. The author, however, in one of his statements—that referring to electrolysis of water pipes—seems confused or unwilling to state the real cure for this evil, which he implies is "a metallic return circuit which shall be amply sufficient to convey to the power house all the energy required to operate the railway system." The real cure is, of course, to have the entire power circuit absolutely insulated from the ground.

DESCRIPTIVE CATALOGUE OF ESSENTIAL OILS AND ORGANIC CHEMICAL PREPARATIONS. Compiled by Frederick B. Power, Ph.G., Ph.D. New York and Garfield, N. J.: Fritzche Brothers, branch of Schimmel & Company, Leipsic and Prague. Pp. v, 96. Price $1.

THE JUCKLINS. A novel. By Opie Read. Chicago: Laird & Lee. 1896. Pp. 291, 12mo. Illustrated, cloth, gilt top. Price $1.

The Horseless Age, a monthly journal devoted to the interests of the motor vehicle industry, is published by E. P. Ingersoll, 157 and 159 William Street, New York City. The subscription price is $2 a year.

The Motocycle is published in Chicago, Ill., by the Motocycle Publishing Company. Price for the United States and Canada is $1 per year. Both of the above publications are liberally illustrated with engravings of the latest motocycles, etc.

Terrestrial Magnetism.—An international quarterly journal, published under the auspices of the Ryerson Physical Laboratory of the University of Chicago. It is edited by L. A. Bauer, with the co-operation of such well known scientists as C. Abbe, W. Von Bezold, T. C. Mendenhall and a number of others. The subscription price is $2 a year; the first number contains an article on electric currents induced by rotating magnets and their application to some phenomena of terrestrial magnetism, Halley's earliest equal variation chart, reproduced in fac-simile for the first time from a photograph furnished by the possessor of the chart. The rest of the periodical is made up of letters to the editor, etc.

The Digest of Physical Tests and Laboratory Practice is published quarterly, by Frederick A. Riehle, Philadelphia. This is a resume of practical tests made in the laboratories of the world. The subscription price is $1 per year. The present number gives an account of testing various engineering materials, such as cements, beams, cast iron car wheels and tests of iron, steel, tests of signal pipe connections, etc. The new publication is freely illustrated.

Good City Government Conferences form the subject of a 500 page octavo published by the National Municipal League, of Philadelphia. It includes the proceedings of the Second National Conference for Good City Government, at Minneapolis, in December, 1894, the first annual meeting of the National Municipal League, and a third national conference at Cleveland in May, 1895.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion: about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue.

Marine Iron Works. Chicago. Catalogue free.

"U. S." metal polish. Indianapolis. Samples free.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

For bridge erecting engines. J. S. Mundy, Newark, N.J.

Handle & Spoke Mchy. Ober Lathe Co., Chagrin Falls, O.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Emerson, Smith & Co., Ltd., Beaver Falls, Pa., will send Sawyer's Hand Book on Circulars and Band Saws free to any address.

For the original Bogardus Universal Eccentric Mill, Foot and Power Presses, Drills, Shears, etc., address J. S. & G. F. Simpson, 26 to 36 Rodney St., Brooklyn, N. Y.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

☞Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(6718) J. H. F. says: Will you please give me a formula for making inking rollers for hand printing presses? A.

Best glue	10½ lb.
Black molasses or honey	2½ gal.
India rubber, dissolved in oil of turpentine	1 lb.
Venice turpentine	2 oz.
Glycerine	12 oz.
Vinegar	4 oz.

The above formula is given for the mysterious black composition, so durable and elastic, and known but to very few persons until recently. Purified India rubber only is used. To recast add 20 per cent new material. The old home receipt is, 2 lb. best glue, soaked over night, to 1 gal. New Orleans molasses. Will not recast.

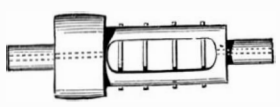
(6719) B. P. asks: 1. Will it seriously interfere with the efficiency of a storage battery to have the area of the negative plate somewhat less than that of the positive? A. No. 2. How can I tell a charged cell from a discharged one? A. By the liquid giving off gas "boiling;" by the color of the positive plate—this is dark red at starting and becomes in the charged cell nearly black; by the specific gravity of solution. 3. Is there any danger of over-charging a cell? A. There is no great harm to be anticipated; it is wasteful of course and gets sulphuric acid into the air and on the connections and so does injury by impairing insulation. 4. What harm is done if the charging current is of too high a voltage? A. None in itself; you simply want to keep a proper amperage. Of course too high a voltage between the cell terminals might give a dangerous amperage. 5. What is a carbureter? A. An apparatus for charging a gas with hydrocarbon vapors. 6. How is petroleum vaporized in petroleum engines? A. It is atomized or blown into fine spray unless volatile enough to form a true vapor. 7. Have you any SUPPLEMENTS on petroleum and gasoline engines? A. We refer to our SUPPLEMENT, Nos. 535, 618, 715, 716, 993, 963, and 1024, price 10 cents each by mail.

(6720) W. S. P. asks: 1. "Experimental Science," page 398, says the Smee battery has an E.M.F. of 1.09 volts when not in action and 0.48.2 when in action. I don't understand why a cell has any E.M.F. when not in action. Please explain. A. A battery by chemical action maintains a potential difference or E.M.F. between its terminals. When on open circuit or not in action this E.M.F. is greatest; when on closed circuit the E.M.F. generally is reduced. The condition on open circuit is comparable to that of a charged Leyden jar; on closed circuit the condition is comparable to that of a jar kept excited while constantly discharging. 2. Is electrical force wasted when sent through a rheostat, i. e., isn't there more economy to use less cells when possible than to use a rheostat? A. Yes, in general terms rheostats are wasteful and their use is to be avoided if possible. 3. In running a small motor which would be the handier and cheaper, an 8 cell Edison-Lalande primary battery type W or a No. 413 chloride accumulator (storage) where it would have to be sent 12 miles for charging at a light station? The first cost of each is nearly the same. A. Probably the storage cell would be best, but no exact estimate of the relative cost can be given from your data. 4. Would the Gramme ring motor, nicely made, as given in SUPPLEMENT, No. 783, develop power enough to run a dental engine if it had battery power sufficient? A. Yes. 5. How large a 4 blade fan would it drive at 2,000 revolutions per minute? A. A twelve inch fan. 6. Does any SUPPLEMENT describe a motor fully that is between the one in SUPPLEMENT, No. 783, and SUPPLEMENT, No. 641, I mean in size? A. We suggest our SUPPLEMENT, Nos. 759, 761,

© 1896 SCIENTIFIC AMERICAN, INC.

and 767. 7. Can you tell if the new compound Fuller battery is suitable to run a small motor? A. Yes. 8. How many hours will the plunge battery, as given on page 401, "Experimental Science," run the motor as described in SUPPLEMENT, No. 641, at a time? After a rest will this battery regain its power? A. The battery, will but slightly regain power; it will run the motor probably four hours to six hours. 9. How many days approximately will one solution run the motor, using it two hours per day? Approximately, how many days would the zincs last, using two hours per day? A. Two or three days. The duration of the zincs may be based on a consumption of 80 grains of zinc per hour in each cell. Besides this about ¼ of the zinc will be wasted in the part above the fluid, so that it will be safe to take ¾ of the weight of the zinc plates in one cell in grains and divide by 80 to get the hours of duration.

(6721) B. J. C. says: Can you inform me how to make a simple machine for straightening wire? A. Such a tool is shown in the accompanying cut. It consists of a casting about 10 in. in length, having on each end a bearing which may be supported in suitable boxes. The pulley is a part of the casting, and is 3 in. in diameter and 2 in. wide. Four steel pins are inserted 1 in. apart and a little to one side of a central longitudinal line. A hole a little larger than the wire to be straightened is drilled axially through the bearing. The wire passes through the tool over and under the steel pins. It is well lubricated and is pulled through as the tool revolves rapidly.



(6722) W. R. B. says: Will you kindly advise me how to prepare gelatine for making gelatine casts, so that it will be non-shrinkable when drying? A. Allow 12 oz. of gelatine to soak for a few hours in water until it has absorbed as much as it can, then apply heat, by which it will liquefy. If the mould is required to be elastic, add 3 oz. of treacle and mix well with the gelatine. If a little chrome alum (precise proportions are immaterial) be added to the gelatine, it causes it to lose its property of being again dissolved in water. A saturated solution of bichromate of potash brushed over the surface of the mould, allowed to become dry and afterward exposed to sunlight for a few minutes, renders the surface so hard as to be unaffected by moisture.

(6723) R. P. G. writes: 1. I have a set of telephones with Blake transmitters and have them on a metallic circuit, but they do not transmit the sound loudly. How can I fix them? A. We can only suggest that you try adjusting the transmitter. Possibly there is dust on the contacts. 2. Does it make any difference whether you wind a magnet even? A. Only that it gives you less wire in the same volume, except in extreme cases, when the distribution of the lines of force is materially affected. 3. How much sulphate of copper does a Crowfoot battery No. 2 take to ring an electric bell a quarter of a mile off? A. There is no question of how much for one or another piece of work. Put in a layer of crystals an inch or two deep. 4. How can I temper brass? A. Long hammering, drawing or rolling will tend to harden it. Heating to redness and quick cooling softens it.

(6724) P. A. R. asks: 1. Is the acetylene gas practicable for both light and fuel in an ordinary family? A. Acetylene gas has not yet been tried on the large scale. It seems probable that it will be practicable if the price is sufficiently reduced. 2. How expensive is it? A. The calcium carbide costs from 50 to 75 cents a pound, giving, perhaps, 4 feet per pound. This price is prohibitive for everyday uses. 3. Do you recommend the apparatus described in your paper for January 4? A. We consider this apparatus a very good one. 4. Will it be necessary to get a book of instruction for making a gas plant of this kind for family use? If so, where can it be obtained? A. We think not. 5. How can I drill a hole in a glass bottle? A. With a file and spirits of turpentine. Use the file in a brace—drill fashion—and sever the edge from time to time by breaking off little fragments. 6. Is there anything that will take out or obliterate ink writing without injury to the paper? Please give formula. I think I heard of a fluid, made in New York, called "Columbian Ink Obliterator." A. Javelle water or solution of hypochlorites with a preliminary application of dilute sulphuric acid.

TO INVENTORS.

An experience of nearly fifty years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices, which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

February 4, 1896,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Album, F. Reifschneider 554,090
Automatic switch, J. F. McElroy 554,080
Axle box, H. A. Hyle 554,186
Axle boxes, dust guard for car, A. C. & D. W. McCord 554,079
Axle cutter, A. C. Saxton 554,034
Babbitt box, W. Leatch 554,224
Baby walker, J. W. Gerl 554,179
Bale tie fastener, E. A. Jablonsky 554,127
Baling press, L. Block 553,827
Barrel attachment, E. Blount 554,211
Bathtubs, etc., leg for, J. H. Stevens, Jr 553,969
Battery. See Electric battery. Secondary battery.
Bearing, ball, C. F. Pontious 554,004
Bed fastening, metallic, P. H. Mellon 554,132
Bed, folding, M. Samuels 554,144
Bed, folding, G. W. Sanor 553,968
Belt stretching machine, Palencsar & Fischer 554,085
Bicycle air pump, W. H. Ostrander 554,084
Bicycle brake, J. H. Ransom 554,031
Bicycle driving mechanism, G. Beekman 553,826
Bicycle lock, G. R. Hillhouse 554,222
Boiler joint, sectional steam, M. O. Roberts 553,870
Bookbinding, C. A. Evertz 554,114
Book cover, F. S. Palmer 553,963
Book, credit coupon, L. P. Hardy 554,182
Book, manifold account and sales, H. D. Keith 553,916
Book, memorandum, S. S. Newton 554,194
Book, pass, U. G. & W. F. Beck 554,169
Bottle filling machine, R. M. Hunter 553,854
Bottle, nursing, H. Matzen 554,071
Bottle, siphon, S. Taylor 554,154
Bottles, apparatus for removing foil from, G. A. Mueller 553,997
Box. See Axle box. Babbitt box. Cigarette box. Fuse box. Postal car paper box. Signal box.
Box machine, cut-off, C. B. Southard 554,152
Brake. See Bicycle brake. Car brake. Car power brake. Fire escape safety brake. Fluid pressure brake.
Brake handle, C. H. Gaffney 553,848
Brick machine, T. T. Wood 553,884, 553,885
Bronze to surfaces of paper, etc., apparatus for applying, C. A. Ruddock 553,941
Broom, J. Bowell 554,214
Burner. See Hydrocarbon burner. Lamp burner.
Button and stud, collar, S. J. Stone 553,944
Button making machine, Carlyle & Nageborn 554,052
Button, self-fastening, C. F. Reichelt 553,938
Cabinet table, G. W. Longstaff 553,860
Cable gripper, W. H. Carr 553,898
Calendar, offertory, S. Moore 553,996
Can making machines, attachment for, A. Johnson 554,027
Cane and music stand, combined, J. Mueller 553,867
Car brake, P. Erb 554,113
Car brake, W. Robinson 553,871
Car brake, W. S. Whitney 553,973
Car brake and fender, combined, A. K. Bonta 554,018
Car, burglar proof, S. H. Williams 554,162
Car coupling, Brandenburg & Chilton 553,835
Car coupling, W. M. Robinson 554,201
Car coupling, J. E. Scott 554,146
Car coupling and brake, combined, O'Brien & Miller 554,195
Car door, J. J. Mulligan 554,078
Car door fastening, F. H. Meyers 554,133
Car fender, Gardner & Carney 553,849
Car fender, J. F. Girtler 554,119
Car fender, W. H. H. Heydrick 554,064
Car fender, Sicard & Frazee 554,149
Car fender, C. Welsh 554,158
Car fender and brake, G. W. Beard 554,167
Car platform buffer, H. H. Sessions 554,007
Car power brake, railway, Wolhaupter & Jones 553,883
Car window ventilator, C. Whitlow 554,160
Cars, bell cord support for street, P. G. Emery 554,218
Carriage, folding baby, G. Mayer 554,072
Carriage runner, baby, J. Anderson 553,822
Case. See Music case.
Catch, T. F. Bourne 553,832
Cattle guard, surface, B. Wolhaupter 553,882
Chain, drive, R. F. Hall 554,181
Chart, astronomical, L. W. Yaggy 554,101
Chest, flour and meal, J. C. Foraker 554,219
Child carrying strap, M. Collins 554,019
Chopper. See Meat chopper.
Cigarette box, W. D. Pittman 554,140
Cigarette machine, D. B. Strouse 554,096
Cigarette machines, filler forming mechanism for, K. H. Carper 554,216
Clamp. See Line clamp.
Clasp, J. V. Washburne 553,972
Cleaner. See Dish cleaner. Track cleaner. Window cleaner.
Clock, electric programme, H. T. R. Zeidler 553,890
Cloth tentering machine clip, T. M. Lincoln 553,859
Clothes lifter, W. Peterson 554,093
Clothes line pin, L. C. Neal 554,137
Clutch, friction, Heath & Verdin 553,993
Cock for compressed gases, shut-off and regulating, W. F. MacLachlan 553,861
Coffee roaster, J. D. Smith 554,094
Communion service, sanitary, C. Forbes 553,846
Commutator for magneto-electric machines, J. C. Henry 554,063
Coop, poultry, W. T. S. Dickey 553,902
Corn husking and fodder cutting machine, G. S. Gundersen 554,061
Corset busk splint, J. S. Metcalfe 553,865
Cot, folding, E. F. Tilley 554,098
Cotton press, J. Little 553,924
Coupling. See Car coupling.
Cover, preserving vessel, Lee & Hazard 553,922
Covering for runways, etc., F. J. Lennon 554,129
Cue tip, T. P. Folger 553,905
Culinary utensil, W. G. Bolus 554,048
Cultivator, H. M. Burdick 553,837
Cultivator, Franzen & Haschemeyer 554,117
Cultivator and chopper, cotton, Spain & Christopher 554,153
Cultivator attachment, D. Parker 554,087
Cultivator attachment, W. T. Ray 553,937
Cup. See Lubricant cup. Oil cup.
Current regulator, automatic, S. C. C. Currie 553,901
Cutter. See Axle cutter. Feed cutter. Pipe cutter.
Dead centers, mechanism for overcoming, W. H. Johnson 554,223
Dental handpiece, H. C. Register 554,032
Diaper, A. L. Stevens 554,203
Dish cleaner, W. H. Mullins 554,135
Dish cleaner, R. W. Springmire 553,943
Door catch, C. H. Paxson 553,868
Door fastener, sliding, Johnston & Cooper 553,856
Downdraught kiln, H. A. Wheeler 553,947
Drill, C. Blakely 554,209
Dry kiln, A. S. Nichols 553,928
Drying kiln, L. Moore 554,134
Egg beater, etc., S. E. Cripe 554,170
Electric arc lighting, G. R. Lean 553,919, 553,921
Electric arc lighting system, G. R. Lean 553,920
Electric battery, C. J. Hirlmann 554 124
Electric battery, Williams & Hamrick 554,043
Electric conductor and contact device therefor, W. P. Allen 554,103
Electric light switch, H. W. Lawrence 553,857
Electric snap switch, G. W. Hart 554,221
Electric transformer, W. K. Freeman 553,847
Electrical circuit closer, L. B. Miller 554,074
Elevator power wheel, G. S. Fouts 554,023
Elevators, automatic stop mechanism for, C. A. Macy 553,862
Embossing machine, M. E. Converse 554,053
Engine. See Momentum engine. Steam engine.
Evaporating apparatus, liquid, C. W. Cooper 553,841
Eyeglasses, J. H. E. De Celles 553,975
Fabric folding machine, F. Debaitre 554,020
Fare register, M. Stopper 553,876
Fastening device, metal, G. G. Wyland 553,886
Feathers from fowls, device for removing, F. T. Busse 554,050
Feed cutter, E. Little 553,925
Felts and wires, automatic guide for, A. H. Smith 554,093
Fence post, H. L. Frick 5 4,220
Fence stay, A. F. Reiste 554,005
Fender. See Car fender.
Fertilizers, apparatus for reducing garbage for, F. G. Wiselogel 554,206
Filter, Lea & Foulke 553,994
Fire escape safety brake, J. W. Hentz 554,025
Fishplate lock, A. E. Trentowsky 554,156
Fishing reel, T. J. Sutton 554,011
Flame, apparatus for focusing, C. H. Land 553,992
Flange forming machine, P. Shellenback 554,148
Fluid pressure brake, H. S. Park 554,086
Fluid pressure regulator, R. Hardie 553,851
Foot extension, E. L. O'Connor 553,929
Fork attachment, carving, J. Forbes 554,173
Form, dressmaker's, W. J. Boyer 553,834
Frogless switch, C. B. Price 553,934
Fruit splitting machine, S. H. Shelley 554,037
Fumes, apparatus for condensing metalliferous, M. W. Iles 553,989
Furnace, Lutz & Schaefer 554,070
Furnaces, air and steam feeding device for, C. C. Mengel, Sr 554,191
Furnaces, explosive valve for blast, T. Coultas 553,956
Furnaces, pressure alarm for gas supply pipes to, F. S. Baker 554,016
Furniture, W. H. Bean 554,017
Fuse box, J. S. Strouse 554,042
Fuse holder and lightning arrester, H. A. Lewis 554,130
Garment hanger, A. C. Jager 554,066
Gas or hydrocarbon burner and furnace, C. H. Land 553,993
Gate, D. H. Good 554,180
Gear for cylinders or other apparatus operated by motive fluids, system of distributing, J. T. F. Conti 554,111
Generator. See Steam generator.
Globe and chimney support, E. S. Butler 554,051
Glove fastener, G. H. Molier 553,866
Glove fastener, W. W. Whitaker 554,100
Glue heater, J. T. Towsley 553,946
Governor, centrifugal, E. Huber 553,852
Governor, steam engine, H. H. Lane 553,918
Grate, H. McGovern 554,193
Grinding machine, C. W. H. Blood 553,828
Gulley or catch basin, concrete stone, E. North 554,000
Gun, recoil operated bolt, W. W. Kimball 554,068
Guns, apparatus for checking recoil of, A. Von Kerpely 553,990
Guns, ejecting mechanism for breakdown, E. G. Parry 554,002
Hanger. See Garment hanger.
Harvester, cotton, Roberson & Moore 554,199
Harvester, self-binding, C. A. A. Rand 554,030
Hay carrier and elevator track, J. E. Porter 554,198
Hay carrier sling, P. A. Myers 554,136
Header and means for manufacturing same, wrought metal, C. P. Higgins 553,912
Heater. See Glue heater. Vehicle heater.
Hinge, blind, T. Corscaden 553,955
Hinge, blind, G. W. Parker 553,931
Hinge, blind, W. E. Stevens 553,970
Hoisting machine brake, C. E. Maris 554,131
Honey section press and foundation fastener, combined, H. Rauchfuss 553,936
Hook. See Whiffletree hook.
Horse detaching device, J. Friedlander 554,118
Hose band, Teal & Crate 554,155
Hose lining apparatus, B. L. Stowe 553,877
Hose nozzle, H. Nicholsburg 553,999
Hose, nozzle holder and spraying attachment for garden, Rollandet & Gray 553,940
Hydrant, Atkinson & West 554,166
Hydrocarbon burner, W. F. Karch 553,915
Ice harvesting machine, D. B. Arnold 554,165
Igniting device, electrical, W. Kaiser 553,960
Insulating joint, W. O. Duntley 553,844
Iron. See Smoothing iron.
Joint, manufacture of, C. P. Sherk et al 553,875
Joint. See Boiler joint. Insulating joint.
Kiln. See Downdraught kiln. Dry kiln. Drying kiln.
Kitchen cabinet, J. C. Wollerman 554,163
Label attaching machine, S. R. Thayer 554,012
Lamp, bicycle, S. Snell 554,009
Lamp, bicycle, E. L. Williams 554,044
Lamp burner, J. C. Shull 554,038
Lamp, electric carriage, P. H. Quinn 554,089
Lamp, self-extinguishing, J. Gregory 553,959
Lamp, vapor, W. Stone et al 554,039
Lamps, regulating socket for incandescent, A. B. Hendricks 553,911
Lathe for boring and facing pulleys, P. Shellenback 554,147
Lifter. See Clothes lifter. Stove lid lifter.
Ligature receptacle G. M. Stratton 554,040, 554,041
Line clamp, P. Rohne 554,006
Liquors, manufacturing fermented and distilled, A. Myers 553,998
Lock. See Bicycle lock. Fishplate lock. Safe lock.
Locomotives, system of supplying water to, A. L. Rich 553,967
Lubricant cup, J. H. Shepheard 554,092
Lubricator, A. T. Ballantine 554,105
Lubricator, E. Huber 553,853
Match machine, E. J. Young 553,888
Measuring and marking fabrics, machine for, Borchers & Forrester 553,895
Measuring device, J. L. Ackerman 553,820
Meat chopper, mixer, and disintegrator, combined, J. W. Farnoff 554,021
Metal strips, machine for winding, F. Purdy 553,935
Metal wheel, F. J. Cooper 554,054, 554,055
Momentum engine, Miller & Collins 554,073
Motion, device for converting, E. W. Hammon 554,062
Mower, J. F. Steward 554,010
Mower, lawn, E. W. McGuire 5 4,081
Music case or portfolio, E. F. Greene 554,060
Music chart, L. J. De Meules 554,172
Music holder, folder and stand, W. Wholton 554,161
Mustache guard, C. Brunn 553,836
Napkin holder, W. Bower 553,833
Oil cup, C. G. Y. King 553,991
Oil cup, C. C. Tyler 553,971
Oil for calming waves, apparatus for distributing, D. Knowles 554,128
Ore concentrator, Rice & Farrar 554,143
Overshoe fastener, G. C. Poling 553,933
Overshoe retainer, F. F. Foster 554,174
Pad. See Paper pad.
Paint, W. J. Reynolds 553,966
Paper bordering machine, P. Gagnieur 553,906
Paper doll, E. C. Betzig 553,893
Paper pad, S. J. Chadwick 554,110
Paper pulp, etc., machine for straining, Torrance & Howell 553,945
Paper tubes, machine for securing seams of, D. B. Strouse 554,095
Pen, ball fountain, S. E. Kochendarfer 554,189
Pencil, C. W. Boman 554,212
Perforator, check, F. Zander 553,889
Perfuming device, F. G. Fisher 554,115
Piano case, T. T. Fischer 553,904
Pianoforte action, T. Cahill 554,108, 554,109
Piano keyboard coupler, E. A. Boehm 553,829
Pin. See Clothes line pin.
Pipe cutter, J. N. Marso 554,028
Planter and cultivator, cotton, S. V. Weeks 554,013
Planter, corn, Hoobler & Headlee 553,913
Planter, potato, T. H. Williams 554,015
Planter, walking seed, L. White 554,159
Plaster, T. W. Heinemann 554,183
Plaster, W. M. Reese 554,142
Plow, E. B. James 553,914
Plow grain drill attachment, gang, A. J. Malsbary 553,926
Plow mouldboard, J. Oliver 553,930
Plow, wheeled, S. B. Secrist 553,874
Portfolio, L. W. Yaggy 553,887
Post. See Fence post.
Postal car paper box, H. H. Sessions 554,008
Potato separator, J. Bach 553,891
Press. See Baling press. Cotton press. Honey section press.
Preservation of vegetable substances, J. S. Du Bois 553,976
Profiling machine, Heath & Verdin 553,984
Profiling machine, multiple, Heath & Verdin 553,988
Propeller screw, A. W. Case 553,953
Pump, lift, J. W. Aiton 554,164
Pump, mining, W. Nance 554,082
Pump valve motion, J. Stumpf 553,878
Pump, water purifying force, D. Heins 553,910
Pumps, valve gear for force and suction, E. W. Koster 553,961
Puzzle, S. A. Bartlett 553,824
Rails to metallic sleepers, securing, J. Whitestone 554,014
Railway, electric, A. Casazza 553,952
Railway, electric, F. C. Esmond 553,979
Railway, electric, Esmond & Gray 553,980
Railway frog, E. N. Grigware 554,120
Railway signaling and switching apparatus, J. D. Taylor 554,097
Railway switch, F. Jewell 554,026
Railway switch, F. Mathews 553,995
Railway systems, circuit controlling device for electric, F. C. Esmond 553,981
Railway ties, manufacturing composition, J. H. Amies 553,821
Railways, automatic gripping device for inclined, O. M. Smith 553,942
Railways, underground system for electric, W. P. Allen 554,102
Railways, underground system for electric, Allen & Krotz 554,104
Ratchet movement, Heath & Verdin 553,987
Recorder. See Sales recorder. Time recorder. Time and signal recorder.
Reel. See Fishing reel.
Reel, White & Lloyd 554,226
Refrigerator, G. W. Jennings 553,856
Register. See Fare register.
Regulator. See Current regulator. Fluid pressure regulator.
Releasing device, animal, J. A. Beamisderfer 554,208
Revolver cylinder stop, C. Foehl 554,058
Roaster. See Coffee roaster.
Safe lock, J. H. Hulse et al 554,126
Sales recorder, manual, W. H. Breakspear et al 554,049
Sandpaper holder, A. Hornig 554,065
Sash, window, C. C. Miller 554,075
Sawing machine, A. G. O'Neil 554,001
Scaffold, F. B. Gilbreth 554,024
Scale, C. F. Edminster 553,978
Scraper, road, H. M. Weaver 553,881
Scraping tool, J. A. Traut 553,879
Screen. See Window screen.
Screen, G. D. Henry 554,122
Screwdriver, electrician's, J. Reece 553,965
Secondary battery, A. E. W. Boucher 553,831
Separator. See Potato separator. Steam separator.
Sewing machine tuck marker, F. L. Goodrich 553,850
Sharpener, scissors, G. R. Ford 554,116
Shears. See Sheep shears.
Sheep shears, S. L. Cohoon 553,954
Shelf and table, convertible, A. J. & J. Jameson 554,187
Shelving, roller, H. N. Booz 554,213
Shirt collar fastener and adjusting device, Wolgemuth & Eagle 553,950
Shock compressor, B. H. Long 553,902
Sifter, ash, H. E. Buck 553,896
Sifter, flour, C. P. Eichler 553,845
Signal apparatus, non-interfering, J. J. Ruddick 553,873
Signal box, non-interference, F. W. Cole 553,839
Signal box, successive non-interference, F. W. Cole 553,838, 553,840
Singletree, H. T. Foster 554,175
Sled runner coupling, S. Yates 553,951
Smoothing iron, F. M. Fournier 554,176
Soldering machine, can, J. Solter 554,151
Sole laying machine, E. E. Winkley 553,948, 553,949
Sole leveling machine, E. C. Judd 554,067
Speaking tube, C. A. Bartliff 553,925
Speed gearing, changeable, J. L. Bogert 554,047
Spinning and twisting machine, R. Dawes 554,217
Spring support for body loops, C. A. Behlen 554,107
Steam engine, H. W. Forslund 554,022
Steam generator, A. W. Finlayson 553,982
Steam separator, C. W. Baker 553,892
Steering apparatus, ship, G. F. Woodman 554,045
Storm protector, G. W. Harmer 554,121
Stove, gas heating, A. L. Pitney 554,197
Stove lid lifter, J. W. Smith 554,150
Stove, vapor, W. H. Woodard 554,207
Stoves, safety casing for oil or gasoline, J. A. Ruth 554,033
Strap. See Child carrying strap.
Strap machine, Leibe & Vanderpool 554,069
Street cleaning machine, C. Beckwith 554,168
Sugar, etc., treating, F. G. Wiechmann 553,974
Suppository and making same, D. Genese 553 907
Suppository machine, D. Genese 554,178
Surveying instrument, Legh & Maclear 554,190
Swing, revolving, G. H. Carlson 554,215
Switch. See Automatic switch. Electric light switch. Electric snap switch. Frogless switch. Railway switch.
Table. See Cabinet table.
Tag or card receptacle, bag, E. P. Cushman 554,171
Telegraph key, W. Deats 554,112
Telegraphy, P. B. Delany 553,957
Telephone, S. A. Dinsmore 553,843
Telephone apparatus, C. J. Schwarze 554,036
Telephone registering apparatus F. Quatram 553,964
Telephone signal bells, adjusting attachment for, C. F. Dunderdale 553,977
Telephone system, W. A. Houts 554,125
Telephony, C. A. Randall 554,141
Thill support, C. Schifferly 554,202
Thrashing machine, H. S. Bonnell 553,894
Time and signal recorder, electric, C. E. Ongley 554,083
Time recorder, workman's, D. Hepp 554,123
Time recorder, workman's, B. S. Wakeman 553,880
Tire, inflatable wheel, A. Pulbrook 553,869
Tool, combination, C. E. Billings 554,046
Toy, M. Bolton 553,830
Track cleaner, J. Baringer 553,823
Track sander, F. M. Dean 554,056
Transplanter, J. S. Ober 554,139
Trolley, electric, N. Muslar 553,927
Trolley wires, spring supporting ear for, C. A. Lieb 553,858
Trousers waistband, J. Schwarz 554,035
Truck, baggage, W. D. Over 554,196
Trusses, metallic block for roof or other, L. Duvinage 553,903
Tube. See Speaking tube.
Turbine, steam, C. A. Parsons 553,932
Turpentine hack, E. Blount 554,210
Typewriting machine, P. Deming 553,842
Typewriting machine, Heath & Verdin 553,909
Typographic machines, tablet holder for, Heath & Verdin 553,986
Typographic machines, type carrier for, Heath & Verdin 553,985
Valve, J. Robinson 553,939
Valve attachment, safety, M. L. Bush 553,897
Valve mechanism, steam engine, C. Schmid 554,145
Valve, straightway stop, G. P. Vincent 554,205
Vehicle heater, T. H. C. Beall 554,106
Vehicle running gear, T. G. Mandt 553,864
Veil fastener, L. M. Graham 554,059
Vending instrument, A. W. & A. H. Roovers 553,872
Ventilator. See Car window ventilator.
Violin tuning peg, G. B. Durkee 554,057
Washboard, Garnes & Zimmerman 554,177
Washboard holder, J. A. W. Sears 554,091
Washer, H. H. Unz 554,099
Weighing machine, automatic, Phillips & Nickerson 554,029
Welding apparatus, electric, H. Lemp 553,923
Well drilling machine, E. Catlin 553,899
Well tubing, gas or oil, W. Moore 554,076
Wells, apparatus for forcing water, etc., from natural gas or other, J. K. & W. B. Johnston 554,188
Wheel. See Elevator power wheel. Metal wheel.
Wheels, manufacture of, W. Strait 554,204
Whiffletree hook, T. G. Mandt 553,863
Whistle controlling device, electrical, A. E. Colgate 553,900
Whistling and musical rattle, A. A. Freeman 553,958
Wind power, mechanical and electrical development and storage of, Negbaur & Feely 554,138
Window cleaner, P. Mulhern 554,077
Window frame, Payment & Hartig 554,088
Window screen, G. K. Monroe 554,192
Wire bending and cutting machine, F. B. Griswold 553,908
Wire, machine for inserting screw threaded, S. W. Robinson 554,200
Wrench, W. H. Rush 554,225
Wrench, J. M. Watson 554,157
Zinc, apparatus for refining, G. M. Holstein 554,185
Zinc, process of and apparatus for refining, Holstein & James 554,184

DESIGNS.

Badge, F. C. Combes 25,113
Brush core, H. M. Livor 25,120
Button, J. M. Litchfield 25,114, 25,115
Carriage robe, baby, H. P. Barlow 25,134
Cigar and ash receiver, J. G. Hutchinson 25,121
Comb, etc., M. C. Lefferts 25,119
Glove fasteners, ball member for, F. F. Raymond, 2d 25,117
Lamp vase, L. Hornberger ..... 25,123 to 25,125
Level frame or block, J. A. Traut 25,130
Pan, W. Fowler, Jr 25,131
Pan, Kahn & Martin 25,132
Paper cutter, J. Slater 25,116
Pipe swage, Dockery & Chouteau 25,127
Pitcher or similar article, A. B. Evans 25,122
Scissors sharpener frame or block, J. W. Slayton 25,126
Shutter bower bracket, G. F. S. & H. Zimmerman 25,129
Skirt retainer, J. T. Moore 25,118
Sleigh, H. A. Moyer 25,135
Stove ash box, L. Kahn 25,133
Telephone toll box, W. Gray 25,128

TRADE MARKS.

Beer, lager, H. Koehler & Company 27,745
Bicycles, National Sewing Machine Company 27,758
Bicycles and tricycles, S. D. Warfield 27,759
Boots and shoes, men's, boys', and youths', Chase, Merritt & Company 27,728
Canned hulled corn, Western New York Preserving and Manufacturing Company 27,742
Cigarettes, Liggett & Myers Tobacco Company 27,751
Cigars, C. Lawrence & Company 27,749
Cigars, J. J. Murphy 27,750
Dairy products, certain named, T. W. Brady & & Company 27,741
Dentifrices, tooth brushes, and packages of same, J. P. Hendrick, Jr 27,731
Firearms and ammunition, Wiebusch & Hilger 27,755
Flour, wheat, Novelty Mill Company 27,743
Liniments, T. S. Waltman 27,740
Lotion for the skin, G. K. Hopkins 27,739
Medicinal preparations, certain named, E. Mather 27,737
Medicinal tablets, certain, Firm of J. A. & W. V. Ritter 27,738
Mineral water, aperient, E. Steinkopff 27,744
Mordants for dyeing purposes, Gilbert Brothers & Company 27,732
Paint, enamel, F. Furness 27,733
Paper and envelopes, Central Ohio Paper Company 27,729
Pens, writing, E. L. Horney 27,730
Remedies, certain named, F. E. E. Shaw 27,736
Remedy for epilepsy and other nervous diseases, fluid, S. A. Richmond 27,734
Remedy for liver diseases, E. L. Andrews 27,735
Rum, Jamaica, W. A. Taylor & Company 27,747
Sewing machines and attachments, Standard Sewing Machine Company 27,756
Threads of all kinds, Jonathan Harris & Sons 27,727
Tires, pneumatic bicycle, Spaulding & Pepper Company 27,757
Tobacco, chewing and smoking, R. J. Reynolds Tobacco Company 27,752
Tobacco, smoking, Richmond Cavendish Company 27,753
Whisky, Firm of C. Nelson 27,776
Whisky, W. A. Taylor & Company 27,748
Wire goods, Oakville Company 27,754

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

© 1896 SCIENTIFIC AMERICAN, INC.

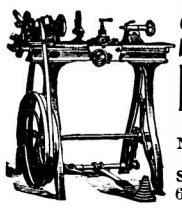
Advertisements.

ORDINARY RATES.

Inside Page, each insertion - - 75 cents a line
Back Page, each insertion - - - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.



Star Lathes ✳ Foot Power, Screw cutting, Automatic Cross Feed
9 and 12 inch Swing.
New Designs. Novel Features.
Send for Catalogue **B.**
SENECA FALLS MFG. COMPANY,
695 Water St., Seneca Falls, N. Y.

AMERICAN PATENTS.—AN INTERESTING and valuable table showing the number of patents granted for the various subjects upon which petitions have been filed from the beginning down to December 31, 1894. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1002.** Price 10 cents. To be had at this office and from all newsdealers.

POWER & FOOT LATHES. SHAPERS, PLANERS, DRILLS, MACHINE SHOP OUTFITS, TOOLS AND SUPPLIES. CATALOGUE FREE.
SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

Machinery at Low Prices. Small Engine Lathes, Foot Lathes, Drills, Printing Presses, Saws, etc. An assortment of first-class tools. We buy, sell, and exchange. WALLACE H. MANSFIELD, NEW HAVEN, CONN.

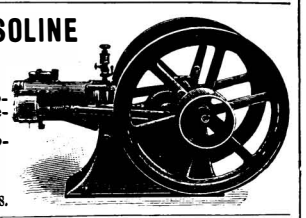
THE CURTIS
Water Pressure Regulator
For Hotels and Public Buildings, Water Motors, Hydraulic Elevators, etc.
Will maintain the pressure desired, with perfect uniformity, regardless of any and all fluctuations in the outside pressure.
☞ *Send for Circular S. F.*
D'ESTE & SEELEY CO.
29-33 Haverhill St., Boston.

THIN STEEL TRY SQUARES
2 in., $1.00 4 in., $2.00
3 " 1.50 6 " 3.00
86 page catalogue of Fine Tools, free.

THE L. S. STARRETT CO. Box 13, Athol, MASS. U. S. A.

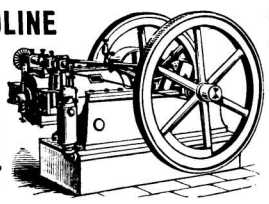
"My Well and what came out of it."
A story by the novelist Frank R. Stockton.
"Your Well and what will come out of it."
By the
Pohlé Air Lift Pump
Bulletins to tell you will be sent on application.
The Ingersoll-Sergeant Drill Co.
Havemeyer Building, 26 Cortlandt Street, New York.

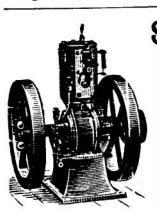
GAS AND GASOLINE ENGINES.
½ to 15 H. P.
Suitable for pumping or any work requiring power.
Prices, etc., upon application.
PIERCE ENGINE CO.
17 N. 17th St., Racine, Wis.



"WOLVERINE" GAS AND GASOLINE ENGINES, STATIONARY and MARINE.
The "Wolverine" is the only reversible Marine Gas Engine on the market. It is the lightest engine for its power. Requires no licensed engineer. Absolutely safe. Manufact'd by
WOLVERINE MOTOR WORKS,
12 Huron Street,
GRAND RAPIDS, MICH.

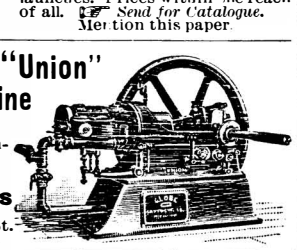
GAS and GASOLINE ENGINES.
Using Natural Gas, Coal Gas, Producer Gas, and Gasoline direct from the tank, 1 to 40 H. P., *actual.*
The Springfield Gas Engine Co.,
21 W. Washington St.,
Springfield, O.



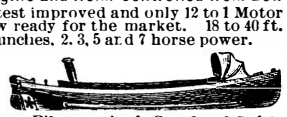


SINTZ GAS ENGINE CO.
GRAND RAPIDS, MICH., U. S. A.
Manufacturers of the **Sintz Stationary and Marine Gas and Gasoline Engines.** Especially adapted for Boats and Electric Lighting. Runs with manufactured or natural gas—Boats and launches. Prices within the reach of all. ☞ *Send for Catalogue.*
Mention this paper.

"Pacific" & "Union" Gas & Gasoline ENGINES.
Marine and Stationary. 1 to 75 h. p.
Safe, Simple, Economical.
The GLOBE GAS ENGINE CO.
Merion Av. & 49th St.
Philadelphia, Pa.



ALCO VAPOR LAUNCH
Engine and Helm Controlled from Bow
Latest improved and only 12 to 1 Motor now ready for the market. 18 to 40 ft. Launches. 2, 3, 5 and 7 horse power.

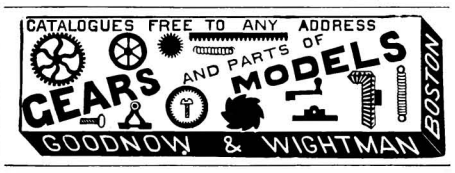


No licensed Engineer or Pilot required. *Speed and Safety guaranteed. No Dangerous Naphtha or Gasoline used.*
Marine Vapor Engine Co., Jersey City, N. J.

The No. 2 Hammond
Possesses
ALIGNMENT—Perfect and permanent
IMPRESSION—Invariably uniform.
TOUCH—Soft, light and elastic.
SPEED—206 words a minute.
DURABILITY—The fewest parts, the best made
VARIETY—12 languages, 37 styles of type, paper or cards of any width or size on one machine.
PORTABILITY—Weighs only nineteen pounds complete, with traveling case.
THE HAMMOND TYPEWRITER CO., - 401 East 62d Street, - NEW YORK

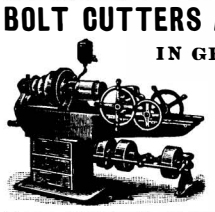
The Daugherty Visible Typewriter
Used by the English Government
Sent on Approval.

Send References.
Price $75.00. *Catalogues on application to*
The Daugherty Tyrewriter Co.
P. O. Box 1260 "C", PITTSBURG, PA.
FACTORY AT KITTANNING, PA.



NEW YORK OFFICE OF
RAND DRILL CO.
Removed February 1st, 1896, to
AMERICAN SURETY BUILDING,
100 Broadway, New York City.

BOLT CUTTERS AND NUT TAPPERS
IN GREAT VARIETY.



Cutting all sizes up to two inches.
WELLS BROS & CO.,
Greenfield, Mass.
P. O. Box B.

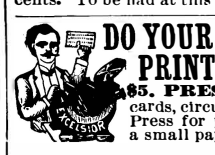
BUY TELEPHONES
That are good—not "cheap things." The difference in cost is little. We guarantee our apparatus and guarantee our customers against loss by patent suits. Our guarantee and instruments are **BOTH GOOD.**
WESTERN TELEPHONE CONSTRUCTION CO.,
440 Monadnock Block, CHICAGO.
Largest Manufacturers of Telephones in the United States

HELLO, CENTRAL!
Long Distance Granular Carbon Telephones! The "best" is the cheapest in the long run, and ours are the best. A trial will convince you. Money back if it don't. Exchanges invited to take a pair on trial. Ten styles to choose from. Drop a postal in the slot and get illustrated catalog and particulars by return mail.
PHŒNIX INTERIOR TELEPHONE CO.,
131 Liberty St., New York.

THE M. & B. TELEPHONE.
Absolutely Non-infringing.
Absolutely Guaranteed.
Absolutely the Best Exchange SWITCH BOARDS.
Illustrated Catalogue on application Free.
. . ☞ *Agents Wanted.* . .
THE U. S. TELEPHONE CONSTRUCTION CO.
131-133 S. Fourth St., PHILADELPHIA.

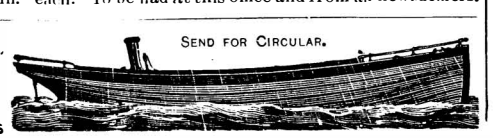
Our New 50c. Telephone
Entirely new and original. The receivers of this Outfit are so constructed that they have extraordinary acoustic properties. A whisper may be plainly heard at 500 ft. No battery required. Receivers are imitation hard rubber, the same in form as used on regular instruments. For inside and all short lines this is better than a $100 Outfit. Complete for both ends with all accessories and instructions for using. Sent by express on receipt of 50c. or by mail for 8c. extra.
R. H. INGERSOLL & BRO. 65 CORTLANDT ST. N. Y. CITY.

THE MODERN ICE YACHT.—BY Geo. W. Polk. A new and valuable paper, containing full, practical directions and specifications for the construction of the fastest and best kinds of Ice Yachts of the latest, most approved forms. Illustrated with engravings drawn to scale, showing the form, position, and arrangement of all the parts. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **624.** Price 10 cents. To be had at this office and of all newsdealers.

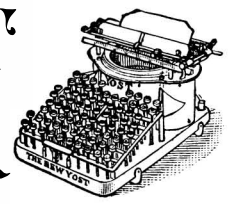


DO YOUR OWN PRINTING
$5. PRESS for cards, circulars, &c Press for printing a small paper, $40.
Save money! Make money printing for others! Type-setting easy. Printed rules. Write for catalogue, presses, type, cards, etc., to factory.
KELSEY & CO.
Meriden, Conn.

MONITOR VAPOR ENGINE AND POWER COMPANY,
8 ERIE STREET, GRAND RAPIDS, MICHIGAN.
GASOLINE LAUNCH ENGINES AND LAUNCHES



YOST NUMBER FOUR.



A writing machine that is superior to all others for its beautiful work, perfect alignment and durability.
YOST WRITING MACHINE CO.
61 Chambers Street, New York.

The Typewriter EXCHANGE,
1½ Barclay St., New York.
156 Adams St., Chicago.
38 Court Sq., Boston.
818 Wyandotte Street, Kansas City, Mo.
We will save you from 10 to 50 per cent. on Typewriters of all makes. ☞ *Send for Catalogue.*

Inventors Promoters Manufacturers

Expert Chemical Services
furnished to Solve Inventive Problems Develop Ideas or for Experimental Work
Have your waste material utilized, your ores assayed, or other products analyzed. Expert advice in chemical, electro-chemical, or chemico-legal matters. *Correspondence confidential.*
MARINER & HOSKINS,
CHEMISTS AND ASSAYERS,
81 Clark Street (top floor). CHICAGO

WELL DRILLING MACHINERY
MANUFACTURED BY
WILLIAMS BROTHERS,
ITHACA, N.Y.
MOUNTED OR ON SILLS, FOR DEEP OR SHALLOW WELLS, WITH STEAM OR HORSE POWER
SEND FOR CATALOGUE
ADDRESS WILLIAMS BROS. ITHACA, N.Y.

THE ORNAMENTAL IRON INDUSTRY.—Description of the method of manufacturing wrought iron into ornamental and artistic forms. With 9 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1020.** Price 10 cents. To be had at this office and from all newsdealers.

If you want the best Lathe and Drill CHUCKS

BUY WESTCOTT'S. *Strongest Grip, Greatest Capacity and Durability, Cheap and Accurate.*
Westcott Chuck Co., Oneida, N. Y., U. S. A.
Ask for catalogue in English, French, Spanish or German.
FIRST PRIZE AT COLUMBIAN EXPOSITION, 1893.

Drawing Instruments Engineers' Supplies
Of German, Swiss, and American make. Drawing Boards, T Squares, Colors, Inks, Tracing Cloths and Papers, Thumb Tacks, Rules, Tapes, etc.
Blue Process Papers,
THE BEST IN THE WORLD.
FROST & ADAMS CO.
Importers,
39 CORNHILL, BOSTON, MASS.
☞ Catalogue Free.

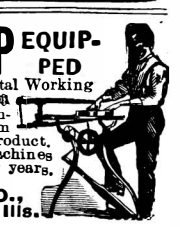
GATES ROCK AND ORE BREAKERS
OVER 3000 IN USE THROUGHOUT THE WORLD
GREATER CAPACITY USING LESS POWER THAN ANY OTHER ON EARTH
MODERN **MINING MACHINERY** OF EVERY DESCRIPTION
GATES IRON WORKS DEPT T
550 ELSTON AVE. CHICAGO.

ACETYLENE GAS AND CARBIDE OF Calcium.—All about the new illuminant, its qualities, chemistry, pressure of liquefaction, its probable future, experiments performed with it. A most valuable series of articles, giving in complete form the particulars of this subject. Apparatus for making the gas. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **998, 1004, 1007, 1012, 1014, 1015, 1016, 1022, 1035** and **1038**; also SCIENTIFIC AMERICAN, Nos. **13**, vol. 72; **23**, vol. 73; and **1**, vol. 74. Price 10 cents each. To be had at this office and from all newsdealers.

ELECTRICITY TAUGHT BY MAIL
Mechanics, Steam Engineering, Mechanical Drawing, Architecture, R. R. and Bridge Engineering, Plumbing, Heating, Mining, English Branches. Send for free circular, stating subject wish to study or your trade.
Correspondence School of Industrial Sciences, SCRANTON, PA.

National TYPEWRITER
IRRESPECTIVE OF PRICE, THE BEST. Trial proves it.
Ask for descriptive booklet "M"
NATIONAL TYPEWRITER CO. 2257 Arch St., Philadelphia, Pa.

WITH YOUR **WORKSHOP** EQUIPPED
With outfits of Barnes Wood and Metal Working ☞ **FOOT POWER** ☜ Machinery you can successfully compete with Factories that use steam power, both in quality and profit on product. The only complete line of such machines made. Have stood the test twenty years. Send for catalogue. Address:
W. F. & JOHN BARNES CO.,
1999 Ruby St., Rockford, Ills.



- - THE - -
SCIENTIFIC AMERICAN
☞ **ESTABLISHED 1845.**
The Most Popular Scientific Paper in the World
Only $3.00 a Year, Including Postage.
Weekly--52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity, Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete list of Patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year* 52 numbers—postage prepaid, to any subscriber in the United States, Canada, or Mexico, on receipt of **Three Dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Postmasters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to
MUNN & CO., 361 Broadway, New York.

Scientific American Supplement

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography Archæology, Astronomy, Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT, for the United States, Canada, and Mexico, $5.00 a year; or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year to one address for $7.00. Single copies, 10 cents. Address and remit by postal order, express money order, or check,
MUNN & CO., 361 Broadway, New York.

Building Edition.

THE SCIENTIFIC AMERICAN BUILDING EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Thirty-two large quarto pages, forming a large and splendid Magazine of Architecture, richly adorned with *elegant plates* and other fine engravings; illustrating the most interesting examples of modern Architectural Construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with Floor Plans, Descriptions, Locations, Estimated Cost, etc.

The elegance and cheapness of this magnificent work have won for it the **Largest Circulation** of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to
MUNN & CO., 361 Broadway, New York.

Export Edition

of the SCIENTIFIC AMERICAN, with which is incorporated "LA AMERICA CIENTIFICA E INDUSTRIAL," or Spanish edition of the SCIENTIFIC AMERICAN is published monthly, and is uniform in size and typography with the SCIENTIFIC AMERICAN. Every number contains about 50 pages, profusely illustrated. It is the finest scientific, industrial export paper published. It circulates throughout Cuba, the West Indies, Mexico, Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. THE SCIENTIFIC AMERICAN EXPORT EDITION has a large guaranteed circulation in all commercial places *throughout the world.* $3.00 a year, postpaid, to any part of the world. Single copies, 25 cents.

☞ Manufacturers and others who desire to secure foreign trade may have large and handsomely displayed announcements published in this edition at a very moderate cost. Rates upon application.
MUNN & CO., Publishers,
361 Broadway, New York.

© 1896 SCIENTIFIC AMERICAN, INC.

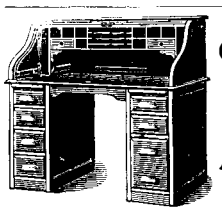
Founded by Mathew Carey, 1785.

HENRY CAREY BAIRD & CO.
INDUSTRIAL PUBLISHERS, BOOKSELLERS & IMPORTERS
810 Walnut St., Philadelphia, Pa., U. S. A.

☞ Our New and Revised Catalogue of Practical and Scientific Books, 96 pages, 8vo, and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

The Philosophy of Science

Popular Scientific Lectures by Ernst Mach. Send for circular No 10, for full particulars and sample copies of periodicals. **OPEN COURT PUB. CO., Chicago.**



WARRANTED OAK · DESKS.

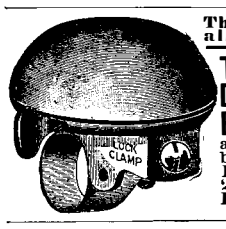
38 inch, - - - $12.00
48 " - - - - 15.00
54 " - - - - 18.00
60 " - - - - 20.00

☞ *Send for Catalogues.*
AMERICAN DESK and SEATING CO.
CHICAGO, U. S. A.

EMPIRE
• BOILER CLEANER •
COMPOUND

We Don't Offer Gratuities, but our Circular will give you the information that will enable you to **Save Time, Trouble and Money.** *Tried, approved, and being used by the Largest Railways and Factories in the East.*
OFFICE:
Temple Bldg., 19 Whitehall St., N.Y.

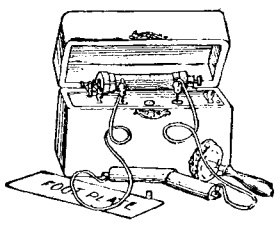
CROOKES TUBES IN ROENTGEN'S Photography.—The new photography as performed by the use of Crookes tubes as a source of excitation. All about Crookes tubes. SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **181, 189, 238, 243, 244, 792, 795, 905** and **980.** These profusely illustrated SUPPLEMENTS contain a most exhaustive series of articles on Crookes tubes and the experiments performed with them Among them will be found Prof. Crookes' early lectures detailing very fully the experiments which so excited the world, and which are now again exciting attention in connection with Roentgen's photography. Price 10 cents each. To be had at this office and from all newsdealers.



They have a tone that's all their own. . . . . .

THE NEW DEPARTURE BELLS are the standard of excellence the world over. Made in 16 different styles and prices. Send postal for booklet to **THE NEW DEPARTURE BELL CO., 210 North Main Street, Bristol, Conn., U. S. A.**

VELOCITY OF ICE BOATS. A COLlection of interesting letters to the editor of the SCIENTIFIC AMERICAN on the question of the speed of ice boats, demonstrating how and why it is that these craft sail faster than the wind which propels them. Illustrated with 10 explanatory diagrams. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **214.** Price 10 cents. To be had at this office and from all newsdealers.



Medical Batteries.
Electric Alarm Clocks.
Dynamo and Motor Castings.
Engine Castings.
TELEPHONES.
Send stamp for catalog.
Palmer Bros.
Box S Mianus, Conn,

TO MANUFACTURERS AND OTHERS

Desiring a representative in Brazil.
The undersigned represented Brazil at the World's Fair, Chicago, 1893. Professor of Machinery at the Navy. Now representing in Brazil several English and Belgian railway firms, and is desirous of making other similar connections. Advertisements for Brazilian publications solicited. Highest of references given. New York reference: Ferraz, Sobrinho & Co., 95 Broad Street. Correspondence solicited. Address
J. CORDEIRO DA GRACA, C.E., M.I.C.E., of London. Office, 92 Rua do Hospicio. P. O. Box 566 Rio de Janeiro, Brazil. *Telegraphic address, "Acarg," Rio de Janeiro.*

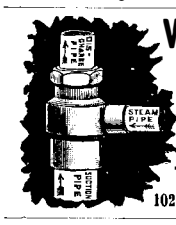
THE IMPROVED PERFECTION CAKE TINS

Loose bottoms. "Don't leak." The groove prevents that. Require no greasing.
More than a million American housekeepers now use these celebrated tins exclusively. We send 2 Round Layer Tins by mail for 35 cts. Write for catalogue showing ten styles – Round, Square and Oblong, and learn all about "The Groove" Exclusive territory to agents. **RICHARDSON MFG. CO., 7 Reade St., Bath, N. Y.**

JAPAN AND CHINA

Do you wish to extend your trade to above-mentioned countries? If so, write or call upon

BURNS, OVERTON & CO.,
Representing H. E. Reynell & Co., of Kobe, Japan.
Constable Bldg., 5th Ave. and 18th St., New York City



VANDUZEN STEAM JET PUMP
THE BEST IN THE WORLD.
Pumps Any Kind of Liquid.
Always in Order, never Clogs nor freezes. Every Pump Guaranteed.
—10 SIZES.—
200 to 12000 Gallons per Hour.
Cost $7 to $75 each. Address
THE E. W. VANDUZEN CO.,
102 to 108 E. Second St., Cincinnati, O.

They All Like It.
The Ladies Like It.
So Do The Men.
Children Enjoy It.
Layman Pneumatic Boats.
☞ See SCI. AM., May 18, 1895.
Send 4c. in stamps for our handsomely illustrated catalogue.
Address H. D. LAYMAN,
30 West 29th St., cor. Broadway, NEW YORK.

A Paper Weight, a Good Timekeeper
Postal Information, all in one gold plated desk clock. A valuable thing on every man's desk. Sample sent for $2.
H. D. PHELPS, ANSONIA, CONN.

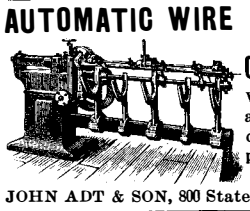
AGENTS WANTED PRICE 25¢

AT LAST WE'VE GOT 'EM! SHARPENERS THAT SHARPEN.

No more dull Knives, Skates, or Shears! You can make the worst old ones you have, good as new in 10 seconds, with the **Diamond Sharpeners. OUR SPECIAL OFFER TO AGENTS, FREE!** **The Diamond Skate Sharpener** fits the curve of any skate. **Beautifully nickeled.** An excellent Christmas gift for the boys. Does the work in a minute. **They Sell to Everybody!** Agents simply hand them out and pull in the quarters. Sample by mail, **25c.**
Diamond Cutlery Co., 60 Broadway, New York, and 1467 State Street, Chicago.

THE BICYCLE: ITS INFLUENCE IN Health and Disease.—By G. M. Hammond, M.D. A valuable and interesting paper in which the subject is exhaustively treated from the following standpoints: 1. The use of the cycle by persons in health. 2. The use of the cycle by persons diseased. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1002.** Price 10 cents. To be had at this office and from all newsdealers.

AUTOMATIC WIRE STRAIGHTENING AND Cutting Machines

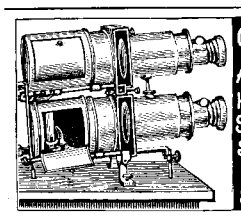


Will Straighten and Cut accurately from 50 feet down, at rate of 135 feet per minute.
For particulars, address
JOHN ADT & SON, 800 State St., NEW HAVEN, CONN.

Scientific Book Catalogue

RECENTLY PUBLISHED.

Our New Catalogue containing over 100 pages, including works on more than fifty different subjects. Will be mailed free to any address on application.
MUNN & CO., *Publishers* SCIENTIFIC AMERICAN,
361 Broadway, New York.



OUR STEREOPTICONS AND OIL LANTERNS HAVE NO EQUAL VIEWS OF ALL SUBJECTS. LOWEST PRICES. SEND FOR CATALOGUE "M"
L. MANASSE
88 MADISON ST. CHICAGO ILL

LIDGERWOOD CABLEWAYS

HOIST AND CONVEY LOADS UP TO 20 TONS. SPANS UP TO 2,000 FEET
150 LIDGERWOOD CABLEWAYS SOLD AND ERECTED.
20 of these Cableways used on the Chicago Main Drainage Canal.
LIDGERWOOD MANUFACTURING CO.
Send for Cableway Sketches. **96 Liberty St., New York**

MESSRS. MUNN & CO., Solicitors of Patents, have had nearly fifty years' continuous experience. Any one may quickly ascertain, free, whether an invention probably is patentable by writing to Munn & Co. Communications strictly confidential. A handbook of patents and how to obtain them sent free.

PATENTS

taken through Munn & Co. receive special notice in the *Scientific American.* This splendid weekly paper, elegantly illustrated, has the largest circulation of any scientific work. $3 a year. Specimen copies free. Address MUNN & CO., New York, 361 Broadway.

IF YOU WANT THE CHEAPEST DYNAMO ON THE MARKET,

DO NOT SEND TO US WE DO NOT MAKE IT. IF YOU WANT A FIRST CLASS DYNAMO AT A FAIR PRICE, WE CAN SUPPLY YOU.
ELBRIDGE ELECTRICAL MFG. CO. ELBRIDGE N.Y.

A. W. FABER

Manufactory Established 1761.
LEAD PENCILS, COLORED PENCILS, SLATE PENCILS, WRITING SLATES, STEEL PENS, GOLD PENS, INKS, PENCIL CASES IN SILVER AND IN GOLD, STATIONERS' RUBBER GOODS, RULERS, COLORS AND ARTISTS' MATERIALS.
78 Reade Street, - - - New York, N. Y.
Manufactory Established 1761.

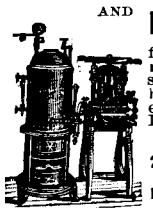
SCIENTIFIC AMERICAN SUPPLEMENT. Any desired back number of the SCIENTIFIC AMERICAN SUPPLEMENT can be had at this office for 10 cents. Also to be had of newsdealers in all parts of the country.

Attachment for Chairs. Pat. Jan. 26, 1896.
A holder for books, packages, hat and umbrella. Light in weight. Readily put in place or removed. A useful and practical rack for cafés, restaurants, etc. Nothing like it on the market. Can be manufactured at small expense. **Patent For Sale.** Correspondence solicited.
L. S. PICKETT, Nevada, Iowa.

RED CEDAR TANKS,

CYLINDERS and CAISSONS—of Pine or Cypress—any size.
WILLIAMS MFG. CO., KALAMAZOO, MICH.
16 Murray Street, New York | 321 Vine Street, Philadelphia, Pa.
36 So. Market Street, Boston | 737 Monadnock, Chicago.

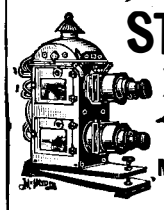
The "Climax" Stereotyper AND Moulding Press Combined,



for making perfect **Celluloid Stereotypes** to be used in place of metal stereotypes. Also for making **Rubber Stamps.** Should be in use in every printing office. See SCI. AM., Dec. 30, 1893. Send for circular to
THE J. F. W. DORMAN CO.
217 E. German St., Baltimore, Md.
Manufacturers of Rubber Stamps, Vulcanizers, Stereotype Machinery and Supplies.

STATISTICS OF THE UNITED STATES. —Abstract of a work by Mr. Henry Gannett, giving some remarkable and little known facts that tell of the growth, the present condition and the resources of the United States. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1011.** Price 10 cents. To be had at this office and from all newsdealers.

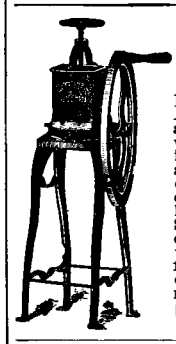
STEREOPTICONS Lantern Slides



WE ARE MAKERS
☞ *Write for Catalogue M.*
McIntosh Battery & Optical Co.
. . CHICAGO . .

N. Y. CAMERA EXCHANGE

50% Saved on all makes of Cameras
Headquarters for Buying, Selling, and Exchanging Cameras or Lenses. Large assortment always on hand. *Developing, printing, etc.*
Photo supplies of every description at *lowest prices.*
☞ *Send 2c. stamp for bargain list.* Address
N. Y. CAMERA EXCHANGE, 43 Fulton St., NEW YORK.



INCUBATORS

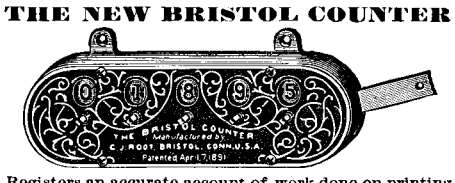
Brooders, Vegetable and Clover Cutters,
BONE AND GRAIN MILLS.
A complete line of poultry supplies at lowest prices. Green cut bone will **MAKE HENS LAY** in Winter and produce fertile eggs for hatching. Send 4c. for catalog and valuable information on poultry raising.

Absolutely Self-Regulating.
Peerless Incubator & Brooder Co.,
516 "A" Ohio Street, Quincy, Ill.

INCUBATORS

Our 160 page, finely illustrated Combined Poultry Guide and Catalogue will tell you what you wish to know about
PROFITS IN POULTRY
We manufacture a complete line of Incubators, Brooders and Poultry Appliances. Guide and Catalogue 10c. (stamps or silver) **Worth one Dollar.**
Reliable Incubator & Brooder Co., Quincy, Ills.

THE NEW BRISTOL COUNTER



Registers an accurate account of work done on printing presses, grain tallies, weighing, measuring and other automatic machines. Counts up to 1,000,000 and repeats automatically. Simple, accurate, durable. Special counters to order. ☞ Send for circular.
C. J. ROOT, Bristol,, Conn. U. S. A.

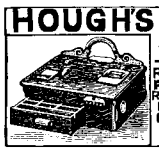
MEN AND WOMEN

Taught to make **Crayon Portraits** in spare hours at their homes by a new copyrighted method. Those learning my method will be furnished work by me, by which they can **EARN $8 TO $16 A WEEK,** Send for particulars
H. A. GRIPP, German Artist, Tyrone, Pa.

A NEW PIPE WRENCH

Grips Quickly and Firmly, GALVANIZED as well as other Pipe, *and will Not Crush it.* Won't lock on pipe. Does not mar nut or highly polished fitting. Other features.
All Dealers.
Send for Little Book, Free.
SAMUEL HALL'S SON, 229 West 10th St., New York.

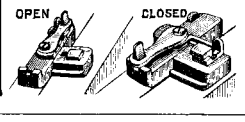
HOUGH'S SECURITY CASH RECORDER.



—ENTIRELY DIFFERENT FROM A CASH REGISTER—IT ENABLES YOU TO **TRACE** AND **PROVE** EVERY TRANSACTION—A COMPLETE RECORD KEEPER—INVALUABLE TO ALL KINDS OF TRADESMEN—THE ONLY MACHINE MADE UPON WHICH YOU **CANNOT FORGET TO RECORD** EACH TRANSACTION.
THE HOUGH CASH RECORDER CO.
SPRINGFIELD, MASS., U.S.A.

NOVELTIES IN SHEET METAL AND WIRE.
Send samples for estimates.
L. R. HITCHCOCK, Watertown, Conn.

For Sale



A valuable patent sash fastener with patent rights issued July 9, 1895. Inclose stamp for particulars. Address the inventor
WM. H. DEANE,
West Berkeley, California

HE IS DEAD

To his own interest, who deals in Arms and Ammunition or who shoots a Rifle Pistol, or shot Gun and has not a copy of IDEAL HAND BOOK, No. 7. A. 100 pages of solid information. Just out. (Mention Scientific American.) BE ALIVE and send for one FREE to all countries. Send stamps for postage.
IDEAL MFG. CO., Drawer A, **New Haven, Ct., U. S. A.**

METAL and WOOD WORKERS' FOOT POWER TOOLS
SCROLL SAWS, MORTISERS, LATHES, FORMERS, CIRCULAR SAWS and **MACHINERY.**
We carry in Stock all the **LEADING** Foot Power Machinery AND MAKE **VERY LOW PRICES!**
Send 4 cents for large Illus. Catalog.
THE WILKINSON CO.,
83 Randolph St., Chicago.

ICE MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton Street, Milwaukee, Wis.

CONTRACTS WANTED.

To manufacture Hardware Specialties, Pat'd Novelties and Sheet Metal Stamping. Lang Mfg. Co., Racine, Wis.

STEEL TYPEWRITER TYPE
TYPE WHEELS, MODELS & EXPERIMENTAL WORK, SMALL MACHINERY NOVELTIES & ETC. NEW YORK STENCIL WORKS 100 NASSAU ST. N.Y.

"DYNAMOS," Care and Management of. 26 illustrations. Pamphlet, Price 25c.
American Industrial Publishing Company, Bridgeport, Conn.

TURBINE WATER WHEELS.

SEND FOR PAMPHLET.
JAMES LEFFEL & CO., Springfield, Ohio, U. S. A.

$525 Agents profits per month. Will prove it or pay forfeit. New articles just out. A $1.50 sample sent free. Try us.
ELECTROGRAPH CO., 28 Bond St., N. Y.

MODEL AND EXPERIMENTAL WORK

Developing **Bicycle** inventions a specialty. Mechanical Draughting. S. P. Denison, 143 Centre St., New York

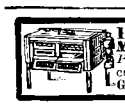
3 Prevents Rust cleans, lubricates, and does not gum. For mechanics' tools, guns, bicycles, typewriting and sewing machines.
Sample of "3 in 1" sent in this oil can to introduce it for five 2c. stamps.
G. W. COLE & CO., 113 B'way, New York

Experimental & Model Work

E. V. BAILLARD, 106 Liberty Street, N. Y.

CONSULTATION AND ADVICE TO INVENTORS.
Experimental work of every description. Automatic machinery designed and built. ☞ Send for circular.
MALTBY MFG. CO., Brooklyn, N. Y.

Incubators and Brooders
Best in the world, hot water, pipe system. Will hatch chicks when others fail. Catalogue Free.
Shoemaker Incubator Co., Freeport, Ill. U. S. A.



HATCH CHICKENS by STEAM.
MODEL EXCELSIOR Incubator. *Simple, Perfect and Self-Regulating.* Thousands in successful use. Send 6c. for Illus. Cat. Circulars free.
GEO. H. STAHL, 114 to 122 S. 6th St. Quincy, Ill.

SHOEMAKER'S POULTRY BOOK
96 pages, printed in 6 colors. Birdseye view of largest Poultry Farm. Tells all about Chickens, Prices of same, their Diseases, remedies, poultry buildings, etc.; finely illustrated. **Price only 15c. C. C. SHOEMAKER, Freeport, Ills, U.S.A.**

ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **59.** Price 10 cents. To be had at this office and from all newsdealers

BUHL TUBULAR HEADLIGHT
IT BURNS IN THE WIND AND
SHINES ALL OVER THE WORLD.
WILL BURN 48 HOURS WITHOUT REFILLING ONE, ONLY ONCE FOR $2.00 BUHL STAMPING CO. DETROIT, MICH.
MANU'RS OF TUBULAR LANTERNS.

How To Make a Dynamo

OR MOTOR. ¼ horse power size, illustrated with full working drawings. By Edw. Trevert. Price 10c.
Bubier Publishing Co., Lynn, Mass.

Hawkins' "Aids" to Engineers
EXAMINATIONS, with Questions and Answers, 5¼ x 7½, leather, gilt edge, **$2.** postpaid. Send for FREE Descriptive Catalogue of this and other Engineers' Books. THEO. AUDEL & CO., 91 Liberty Street, NEW YORK, N. Y.

CARBORUNDUM
HARDEST ABRASIVE KNOWN. EMERY AND DIAMOND POWDER SUBSTITUTE. IN FLOUR, POWDER, CRYSTAL—WHEEL, SLAB & HONE FORM.
CARBORUNDUM CO. MONONGAHELA CITY, PA. U.S.A.

WOODEN TANKS.

For Railroads, Mills and Manufactories.
Builders of Steel Towers and Tanks.
La. Red Cypress Wood Tanks a specialty.
W. E. CALDWELL CO.,
217 E. Main Street, Louisville, Ky.

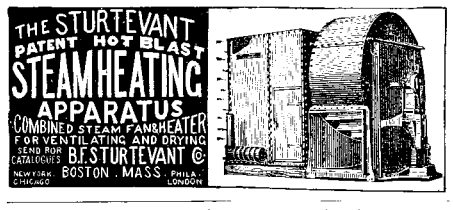
FIRE BRICK FOR ALL PURPOSES.

. . . . . ☞ *Send for Prices and Catalogue.*
BROOKLYN FIRE BRICK WORKS.
88 Van Dyke Street, BROOKLYN, N. Y.

THE FADING OF PIGMENTS.—A PAper by Capt. W. DeW. Abney, discussing the action of the various rays of the spectrum upon colors. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1016.** Price 10 cents. To be had at this office and from all newsdealers.

BRASS BAND

Instruments, Drums, Uniforms, Equipments for Bands and Drum Corps. Lowest prices ever quoted. Fine Catalog, 400 Illustrations, *mailed free;* it gives Band Music & Instructions for Amateur Bands.
LYON & HEALY, 33-35 Adams St., Chicago.



WANTED Names of persons desiring to take out patents. **O. Jones, Wilmington, Vt.**

© 1896 SCIENTIFIC AMERICAN, INC.

Advertisements.

ORDINARY RATES.

Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

Unanimous Choice

The New York Morning Journal recently offered ten leading makes of bicycles as prizes in a guessing contest, giving the winners free choice of any one of the ten machines. The result was ALL of the ten winners selected

Columbia Bicycles

The Journal accordingly bought ten Columbias, paying $100 each for them, without discount or rebate. On even terms few will choose a bicycle other than the Columbia

STANDARD OF THE WORLD
Unequalled, Unapproached.

Beautiful Art Catalogue of Columbia and Hartford Bicycles is free if you call upon any Columbia agent; by mail from us for two 2-cent stamps.

POPE MANUFACTURING CO.
Factories and General Offices, Hartford, Conn.

Branch Stores and Agencies in almost every city and town. If Columbias are not properly represented in your vicinity let us know.

HALF A CENTURY OF CYCLES.—AN interesting history of the cycle from its origin up to the present time. The first crank-driven bicycle. The "bone-shaker" and its successors. The tricycle. The modern wheel. Cycle building a science. Points of improvement. The pneumatic tire. A hand and foot cycle. With 9 illustrations. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1012. Price 10 cents. To be had at this office and from all newsdealers.

JESSOP'S STEEL THE VERY BEST
FOR TOOLS, SAWS ETC.
Wm JESSOP & SONS Ltd 91 JOHN ST. NEW YORK

The American Bell Telephone Company,

125 Milk Street,
Boston, Mass.

This Company owns Letters-Patent No. 463,569, granted to Emile Berliner November 17, 1891, for a combined Telegraph and Telephone, covering all forms of Microphone Transmitters or contact Telephones.

Waverley BICYCLES.

HALF NICKEL FRONT FORK

ARE THE CHOICE OF EXPERIENCED RIDERS,

Those who have learned to know the difference between a wheel that actually is high grade, and one that is simply claimed to be. Others may be good, but the Waverley is the **Highest of all High Grades.**

REWARD of a new Waverley Scorcher is offered to each person who recovers a stolen '96 Waverley during 1896, payable upon presentation to us of satisfactory proof of the facts and the sentence of the thief. This reward is open to every one excepting the owner of the stolen wheel, but is not payable to more than one person in any case.

ART CATALOGUE FREE BY MAIL. INDIANA BICYCLE CO., INDIANAPOLIS, IND.

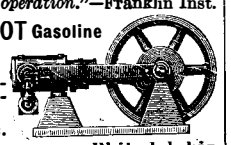
"I CAN'T RIDE BUT IF I COULD
YOU JES BET I'D RIDE A
"Crescent"
THE Strongest AND EASIEST RUNNING BICYCLE IN THE WORLD.
WESTERN WHEEL WORKS.
CHICAGO. BUILDERS NEW YORK.
SEND FOR CATALOGUE

The $5.00 POCKET KODAK

EASTMAN KODAK CO.,
Sample photo and booklet for two 2-cent stamps. ROCHESTER, N. Y.

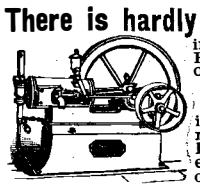
. . . WE ARE BUILDING . . .
The Celebrated
"HORNSBY-AKROYD"
OIL ENGINE
The De La Vergne Refrigerating Machine Co.
FOOT E. 138TH STREET, NEW YORK.

PRIESTMAN SAFETY OIL ENGINE
"Phenomenally low in cost of operation."—Franklin Inst.
NEITHER STEAM NOR ENGINEER
Kerosene, NOT Gasoline



Economical, Simple, Safe, Automatic. For Electric Lighting, Pumping, Milling, etc.
PRIESTMAN & COMPANY, Inc.
Front and Tasker Streets, - - Philadelphia

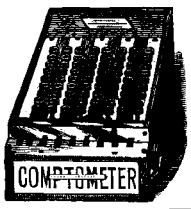
There is hardly a USE OF POWER



in Factory, Mill, Store, Office, Elevator, Creamery, or Shop—or on the Farm, the
"CHARTER"
is not now filling. It is also running Boats, Well Drills, Pumps, Dynamos, Threshing Machines, etc. Of course it also uses Gasoline.
CHARTER GAS ENGINE CO., P. O. Box 148, Sterling, Ill.

AGENTS WANTED FOR FINE TOOLS IN EVERY SHOP.
WRITE FOR CATALOGUE AND AGENCY.
C. H. BESLY & CO.
CHICAGO, ILL. U.S.A.

NO BURNING OUT DYNAMOS OR MOTORS. We guarantee our AUTOMATIC CIRCUIT BREAKERS to protect Dynamos and Motors from short circuit from any outside causes, including lightning. We manufacture a switch that opens on overload or when no current is passing. Our street car switch is perfection. All our switches open with a fraction of an ampere excess current over set capacity. Made for Direct or Alternating Currents, any voltage. *Catalogue Free.* . . .
AUTOMATIC CIRCUIT BREAKER CO.
—NEWAYGO, MICHIGAN, U. S. A.—

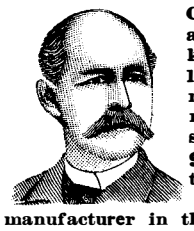


ALL ARITHMETICAL PROBLEMS solved rapidly and accurately by the Comptometer. Saves 60 per cent of time and entirely relieves mental and nervous strain. Adapted to all commercial and scientific computation. Why don't you get one? *Write for pamphlet.*
FELT & TARRANT MFG. CO.
52-56 ILLINOIS ST. CHICAGO.

ASK YOUR DEALER FOR
W. L. DOUGLAS
$3. SHOE BEST IN THE WORLD.

If you pay $4 to $6 for shoes, examine the W. L. Douglas Shoe, and see what a good shoe you can buy for **$3.**

OVER 100 STYLES AND WIDTHS,



CONGRESS, BUTTON, and LACE, made in all kinds of the best selected leather by skilled workmen. We make and sell more $3 Shoes than any other manufacturer in the world.

None genuine unless name and price is stamped on the bottom.

Ask your dealer for our **$5, $4, $3.50, $2.50, $2.25** Shoes; **$2.50, $2** and **$1.75** for boys.

TAKE NO SUBSTITUTE. If your dealer cannot supply you, send to factory, enclosing price and 36 cents to pay carriage. State kind, style of toe (cap or plain), size and width. Our Custom Dept. will fill your order. Send for new Illustrated Catalogue to **Box K.**

W. L. DOUGLAS, Brockton, Mass.

At 1/4 Price Bicycles, Watches Guns, Buggies Harness, Sewing Machines Organs. Pianos Safes, Tools Scales of all varieties and 1000 other articles. Lists free. CHICAGO SCALE CO., Chicago. Ill.

ALWAYS RELIABLE
Overland CYCLES
$45, $65, $75. Guaranteed equal most $100 models. Handsome, high grade, light; also Sylph, surpassing all, $100. Agts. wanted. Cata. free Rouse, Hazard & Co., Makers. 16 G. St., Peoria, Ill.

MANUFACTURE OF BICYCLES.—A very comprehensive article giving the details of construction of every part of these vehicles. With 15 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 908. Price 10 cents. To be had at this office and from all newsdealers.

If you want any **Rope** *For Transmission of Power*
We have furnished Rope for some of the largest Drives in the country.
WRITE TO US.
H. CHANNON COMPANY,
24-26 Market St. CHICAGO.

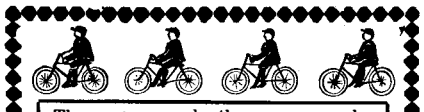
Patee Bicycles

Have dust-proof bearings that are dust proof, large tubing, 5 inch tread, latest pattern continuous cranks and crank shaft. Tubular hubs wide between spokes, and straight rear braces. In fact, are thoroughly modern in all respects. Built by men who have every facility that money can buy for the production of the best machine, backed by 18 years' practical experience.

PRICES
$60 and $85.
Peoria Rubber & Mfg. Co.,
PEORIA, ILLS.

AGENT WANTED in every town. Best seller made. Write for terms and discounts.

ENGINES, Boilers and Machine Tools. New and Second-hand. *Send stamp for paper "Machinery & Supplies."* W. P. Davis, Rochester, N. Y



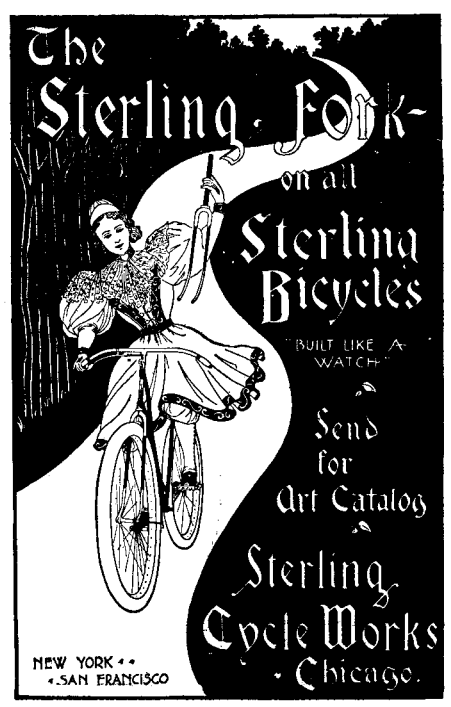
There are monarchs, there are monarchs,
Men of every clime and hue,
From the Czar of all the Russias
To the Prince of Timbuctoo:
Monarchs good and monarchs famous,
Monarchs short and monarchs tall;
But the *best* is *our* Monarch—
It's the Monarch of them all.

Monarch

King of Bicycles—A Marvel of Strength, Speed and Reliability.

4 models, $80 and $100, fully guaranteed. For children and adults who want a lower price wheel the *Defiance* is made in 3 models, $40 to $75. Send for Monarch book.

MONARCH CYCLE MFG. CO.,
Lake, Halsted and Fulton Sts., CHICAGO.
83 Reade Street, New York.



How to Build a Home

Those intending to build will find the very best practical suggestions and examples of Modern Architecture in the Handsomest Architectural Magazine ever published

"The Scientific American Building Edition."

Each number is illustrated with a *Colored* plate and numerous handsome engravings made *Direct from Photographs of Buildings*, together with interior views, floor plans, description, cost, location, owners' and architects' names and addresses. The illustrations include city and country residences, churches, schools, public buildings, stables, etc.

All who contemplate building, or improving homes or structures of any kind, have in this handsome work an almost endless series of the latest and best examples from which to make selections, thus saving time and money.

PUBLISHED MONTHLY.
Subscriptions $2.50 a Year. Single Copies 25 cents
For sale at all news stands, or address
MUNN & CO., Publishers,
361 Broadway, New York.

RIDE THE **HUNTER CYCLES**
SEND FOR CATALOGUE
HUNTER ARMS CO.
FULTON N. Y.

PRINTING INKS.
The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York

© 1896 SCIENTIFIC AMERICAN, INC.